KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE – 641 049

(An Autonomous Institution Affiliated to Anna University, Chennai)

REGULATIONS - 2014

CURRICULUM AND SYLLABI FOR I & II SEMESTERS

KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE - 641049
(An Autonomous Institution Affiliated to Anna University, Chennai)

SEMESTER – I
(**COMMON TO ALL BRANCHES OF ENGINEERING & TECHNOLOGY**)

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*101	Functional English I	2	0	2	3
U14MA*T*101	Engineering Mathematics – I	3	1	0	4
U14PH*T*101	Engineering Physics	3	0	0	3
U14CH*T*101	Engineering Chemistry	3	0	0	3
U14ME*T*101	Engineering Graphics	2	0	3	3
U14CS*T*101	Structured Programming using 'C'	3	1	0	4
PRACTICAL					
U14PH*P*101/ U14CH*P*101	Physics Laboratory / Chemistry laboratory*	0	0	3	1
U14ME*P*101	Engineering Practices Laboratory	0	0	3	1
U14CS*P*101	Structured Programming Laboratory using 'C'	0	0	3	1
U14GH*P*101	Personal Values	1	0	1	1

TOTAL – 34 HOURS **TOTAL CREDITS – 24**

*Physics Lab is offered for 50% of the classes and Chemistry lab for remaining 50% of the classes in the first semester. In the second semester the labs are interchanged.

SEMESTER	**AE, CE, CSE, IT, ME, MCE**	**AU, BIO, EEE, ECE, EIE, FT, TXT**
First semester	U14PH*P*101- PHYSICS LAB	U14CH*P*101 - CHEMISTRY LAB
Second semester	U14CH*P*201- CHEMISTRY LAB (Except CSE Branch)	U14PH*P* 201 - PHYSICS LAB

B.E - AERONAUTICAL ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CH*T*202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14AE*T*201	Elements of Aeronautics	3	1	0	4
PRACTICAL					
U14CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14AE*P*201	CAD Laboratory - I	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDIT – 25**

B.E – AUTOMOBILE ENGINEERING

SEMESTER – II

Code No.	**Course Title**	**L**	**T**	P	**C**
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CH*T*202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14EE*T* 211	Basics of Electrical and Electronics Engineering	3	0	0	3
	PRACTICAL				
U14PH*P*201	Physics Laboratory	0	0	3	1
U14AU*P*201	CAD Laboratory	0	0	3	1
U14EE*P*211	Basics of Electrical and Electronics Engineering Lab	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

B.Tech – BIOTECHNOLOGY

SEMESTER – II

Code No.	**Course Title**	**L**	**T**	**P**	**C**
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*206	Applied Physics	3	0	0	3
U14CH*T*205	Chemistry for Biotechnology	3	0	0	3
U14EET211	Basics of Electrical and Electronics Engineering	3	0	0	3
U14BT*T*201	Biomolecules and Genetics	3	0	0	3
	PRACTICAL				
U14PH*P*201	Physics Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14BT*P*201	Biomolecules and Genetics Laboratory	0	0	3	1
U14GH*P*201	**Family&professional values**	1	0	1	1

TOTAL – 31 HOURS **TOTAL CREDITS – 23**

B.E CIVIL ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics II	3	1	0	4
U14PH*T*201	Materials Science	3	0	0	3
U14CH*T*201	Chemistry for Civil Engineering	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14CE*T*201	Construction Materials	3	0	0	3
PRACTICAL					
U14 CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14CE*P*201	Construction Materials Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

B.E - COMPUTER SCIENCE AND ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14EE*T*212	Electrical and Electronic Circuits	3	1	0	4
U14IT*T*201	Foundations of Information Technology	3	0	0	3
U14CS*T*201	Digital Systems and Design	3	1	0	4
PRACTICAL					
U14EE*P*212	Electrical and Electronic Circuits Laboratory	0	0	3	1
U14CS*P*201	Computer Hardware Lab	0	0	3	1
U14CS*P*202	Digital Systems and Design Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDITS – 25**

B.E - ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER - II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14EC*T*201	Circuit Theory	3	1	0	4
U14EC*T*202	Electron Devices	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14EC*P*201	Electric Circuits and Simulation Laboratory	0	0	3	1
U14EC*P*202	Electronic Devices Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDITS – 24**

B.E - ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*205	Applied Physics	3	0	0	3
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14EE*T*201	Circuit Theory	3	1	0	4
U14ME*T*204	Thermal Engineering and Fluid Mechanics	3	1	0	4
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14EEP201	Basics of Electric Circuits lab	0	0	3	1
U14ME*P*202	Thermal Engineering and Fluid Mechanics Lab	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDIT – 25**

B.E - ELECTRONICS AND INSTRUMENTATION ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14EC*T*201	Circuit Theory	3	1	0	4
U14EI*T*201	Electronic Devices	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14EI*P*201	Circuits and Devices Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

B.Tech - TEXTILE TECHNOLOGY (FASHION TECHNOLOGY)

SEMESTER – II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*204	Applied Physics	3	0	0	3
U14CH*T*204	Chemistry for Textiles	3	0	0	3
U14FT*T*201	Fiber Science and Yarn Technology	3	0	0	3
U14FT*T*202	Weaving Technology	3	0	0	3
	PRACTICAL				
U14PH*P*201	Physics Laboratory	0	0	3	1
U14FT*P*201	Textile Production Process Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 31 HOURS **TOTAL CREDIT – 23**

B.Tech - INFORMATION TECHNOLOGY

SEMESTER – II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14EE*T*212	Electrical and Electronic Circuits	3	1	0	4
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14IT*T*201	Foundations of Information Technology	3	0	0	3
	PRACTICAL				
U14CH*P*202	Chemistry Laboratory	0	0	3	1
U14EE*P*212	Electrical and Electronic Circuits Laboratory	0	0	3	1
U14IT*P*201	Computer Hardware and Peripherals Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDIT – 24**

B.E - MECHANICAL ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CHT202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14EE*T*211	Basics of Electrical & Electronics Engineering	3	0	0	3
	PRACTICAL				
U14CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14EE*P*211	Basics of Electrical & Electronics Engineering Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

B.E - MECHATRONICS ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CH*T*202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14MC*T*201	Electronic Devices and Circuits	3	0	0	3
PRACTICAL					
U14CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14EC*P*207	Electronic Devices and Circuits Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDIT – 24**

B.Tech - TEXTILE TECHNOLOGY

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*204	Applied Physics	3	0	0	3
U14CH*T*204	Chemistry for Textiles	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14TX*T*201	Textile Fibers	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14TX*P*201	Fiber Analytical Laboratory	0	0	3	1
U14GH*P*201	Family&Professional Values	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

U14EN*T*101/ FUNCTIONAL ENGLISH - I	L	T	P	C
(Common to all branches of Engineering and Technology)	**2**	**0**	**2**	**3**

OBJECTIVES

- Discover an understanding of the process of oral communication
- Originate knowledgeable audience-centered speaking
- Formulate a significant training ground for the development of student's abilities in public speaking
- Create multiple opportunities for students to practice and share their reading skill development
- Improve critical thinking and analytical skills
- Develop a milestone for leadership and group participation through communication skills

READING: FUNDAMENTALS OF ENGLISH **15 Hours**

Fundamentals of English Grammar - Basics of sentence completion - Syntax- Giving facts and explaining functions and processes - Explaining concepts and ideas - Giving encouragement: phrases for positive feedback; more emphatic adjectives and adverbs - Giving, getting and checking information - Signaling the structure of a presentation – introducing, sequencing and concluding a talk - Reading a report - New technologies and change - News Paper Reading.

WRITING: BASIC STRATEGIES OF WRITING **15 Hours**

Agreeing and disagreeing – Practice of frequency - Article Writing (Critical writing- Creative writing)- Anecdote Formation - Greeting friends and strangers - Short prepared compositions on current affairs - Writing a proposal for conducting science exhibition - Factual business letters and E-mail etiquette

LISTENING: LANGUAGE ACQUISITION **15 Hours**

Descriptive words and regular - irregular verbs - Conversation between old friends; introducing others - Tense and voice - Establishing relationships and negotiating - Discussion on Practical business tasks- Ordering or answering enquiries - Short telephone conversations - Outline a problem and present a solution - Fluency Drills- British and American equivalents..

SPEAKING: ADEPTNESS OF ARTICULATION **15 Hours**

Practice of phonetic transcription (Vowel and Consonant symbols) - Presenting information - General business discussions and factual discussions -Giving and getting product information - Describing organizations - Practicing of conversation starters and closers with friends and strangers - Asking about possibility/preference - Offering help - Seeking permission – Persuading - Talking about people and places - Explaining ideas and visual information

L: 30 Hr, T: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering, Cambridge University Press,. 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult &Academic ESL, .2003.
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009
5. Guy Brook – Hart, BEC Vantage- Business Benchmark Upper – Intermediate, 2006

COURSE OUTCOMES

- Formulate and practice effective reading strategy to enhance technical communication
- Assess strengths in writing skills and set goals for future growth
- Practice and perceive the full repertoire of listening strategies by using authentic listening tasks
- Create learning situations to develop speaking skills based on sound educational and communication theories.

U14MA*T*101/ ENGINEERING MATHEMATICS -I (Common to all branches of Engineering and Technology)	L	T	P	C
	3	1	0	4

OBJECTIVES:

On completion of the course the students are expected

- To know eigen values and eigen vectors and diagonalization of a matrix.
- To know about the geometrical aspects of curvature, evolute and envelope.
- To solve ordinary differential equations of certain types and its application.
- To understand the concepts of partial differentiation, maxima and minima.

MATRICES **9 Hours**

Rank of a matrix – Linearly dependent and independent vectors – Eigen values and eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem (excluding proof) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS **9 Hours**

Curvature – Radius, Centre and Circle of curvature in Cartesian, Parametric and Polar form – Evolute – Envelope of family of curves with one and two parameters – Evolute as the envelope of normals – properties of evolute and envelope.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS **9 Hours**

Leibnitz's equation – Bernoulli's equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories and simple Electric circuit problems.

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS **9 Hours**

Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients - Application - Oscillatory electrical circuit. (Differential equations and associated conditions need to be given).

FUNCTIONS OF SEVERAL VARIABLES **9 Hours**

Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians.

L: 45 + T: 15 = 60 Hours

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition.
2. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
3. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics",S. Chand & Co., New Delhi, (Reprint) 2008.
4. Kreyzig E., "Advanced Engineering Mathematics", Eighth Edition, John Wiley and sons, 2010.
5. Arunachalam, T., Engineering Mathematics I, Sri Vignesh Publications, Coimbatore. (Revised) 2009.
6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai, 2003.
7. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).

Course Outcome

After pursuing the above mentioned course, the students will be able to:

- Know eigen values and eigen vectors and its role in the system of equations.
- Discover the radius, centre and circle of curvature of any curves.
- Solve the ordinary differential equations of certain types and its applications.
- Identify the maximum and minimum values of surfaces

U14PH*T*101/ ENGINEERING PHYSICS	L	T	P	C
(Common to all branches of Engineering and Technology)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in

- Various engineering subjects and applications.
- Structure identification of engineering materials.
- Non-destructive techniques.
- Interferometric techniques in metrology and electrical phenomena.
- Application of lasers in engineering and technology.
- Atomic and Nuclear related theories.

CRYSTAL PHYSICS **9 Hours**

Space lattice – unit cell – lattice planes – Bravais space lattices – Miller indices – calculation of interplanar distances – Atomic radius – co- ordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal imperfections – point defects – line defects – surface defects – volume defects – effect of crystal imperfections.

APPLIED OPTICS **9 Hours**

Interference – airwedge and its applications – Michelsons interferometer – construction, working – determination of wave length and thickness – Lasers – spontaneous and stimulated emissions – Einsteins coefficients – Nd: YAG, Co_2 and semiconductor laser – Homojunction and Hetrojunction (only qualitative description) – applications – CD-ROM and holography (qualitative only) – optical fibre – principle and propagation of light in optcal fibers – Numerical aperture and acceptance angle – types of optical fibres – applications – fibre optic communication system – medical endoscopy.

QUANTUM PHYSICS **9 Hours**

Plancks quantum theory of black body radiation (derivation) – Photo electric effect – Compton effect (derivation) and experimental verification of Compton effect – De-broglies concept - Schrodinger wave equation – time independent and time dependent equations (derivations) – physical significance of wave function – particle in a box (one dimensional case) – Electron microscope – Scanning electron microscope – Transmission electron microscope.

ULTRASONICS AND NDT **9 Hours**

Introduction – production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezo electric generator –properties –detection – cavitation –acoustic grating – velocity measurement – applications –Sonar –velosity of blood flow – NDT –Liquid Penetrant method – Ultrasonic flaw detector – A scan, B scan, C scan – X- ray radiography and fluoroscopy – Thermography.

ATOMIC AND NUCLEAR PHYSICS **9 Hours**

Introduction – Atomic spectra – Molecular spectra – Applications – Raman effect – Stokes lines and anti stokes lines – Applications – Nuclear models – Liquid drop model – The Shell model- Nuclear fission – Theory – Energy released per fission – Chain reaction – Controlled chain reaction – Nuclear reactors – Condition for sustained chain reaction – Types of Nuclear reactors – Nuclear fusion – Thermo nuclear reactions – Differences between fission and fusion

TOTAL: 45 HOURS

REFERENCES

1. Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Gopal S., Engineering Physics, Inder Publications, Coimbatore, 2006.
3. Palinisamy P.K., Engineering Physics I, Scitech Publications, Chennai, 2011.
4. Avadhanulu M.N. andKshirsagar P.G., A textbook of Engineering Physics, S.Chand & Company Ltd, New Delhi,2005.
5. Gaur R.K. and Gupta S.L., Engineering Physics, 8^{th} edition, DhanpatRai Publications (P) Ltd., New Delhi, 2003.

COURSE OUTCOMES

- Analyze and identify the crystal structure in materials
- Categorize and illustrate the optical materials and its application to engineering
- Examine and compare samples at nano level
- Apply the NDT techniques and modern engineering tools necessary for engineering practice.
- Discuss the role of nulear physics in energy production

U14CH*T*101/ ENGINEERING CHEMISTRY (Common to all branches of Engineering and Technology)	L	T	P	C
	3	0	0	3

OBJECTIVES

- To inculcate an understanding of the importance of chemistry by providing an overall perspective of theoretical and modern technological aspects of applied chemistry before beginning their more specialized courses.
- To embellish the usage of chemistry to exhibit engineering and technical concepts

ELECTROCHEMISTRY **9 Hours**

Introduction - Electrode potential – Nernst equation and problems - Electrochemical series - Application of EMF measurements & problems - Kohlrausch law of independent migration of ions & its application - Conductometric titrations (acid - base & precipitation titration)

Electrodes : Standard and reference electrode (Hydrogen & Calomel) – Types of electrodes (Metal – Metal ion; Metal – Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) – determination of pH using glass electrode

Cells : Galvanic cell – Types of concentration cells

ENERGY STORING DEVICES **9 Hours**

Batteries : Primary Battery (Lechlanche & Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery & Lithium – Polymer battery) – Flow battery (Hydrogen and Oxygen Fuel Cell)

Solar Cells: Hybrid Solar cells

Nuclear Reactors: Light water nuclear power plant (nuclear fission) - ICF (nuclear fusion)

THERMODYNAMICS **9 Hours**

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy – first law of thermodynamics (Mathematical derivation & limitation) - Enthalpy - Second law of thermodynamics - Entropy - Entropy change of an ideal gas & problems - Free energy - work function - Gibbs Helmholtz equation (derivation, applications & problems) - Van't Hoff isotherm (derivation & problems) - Van't Hoff isochore - (derivation & problems) - Third law and zeroeth law (Only statements)

SURFACE CHEMISTRY **9 Hours**

Introduction of adsorption - Types of Adsorption - Adsorption isotherm (Freundlich isotherm, Langmuir adsorption isotherm, BET isotherm) - Applications of adsorption : Role of adsorption in catalytic reactions, Ion exchange adsorption, adsorption chromatography (Column chromatography)

SPECTROSCOPY **9 Hours**

Introduction to spectroscopy - Beer Lambert's Law - Colorimetric analysis (principle, instrumentation (block diagram only) & application (Estimation of concentration of Ferrous and copper ions a solution by colorimetry) - UV – visible spectroscopy (principles, instrumentation (block diagram only) & simple Applications) - IR spectroscopy (principles, instrumentation (block diagram only) & simple applications) - Flame photometry (Principle, instrumentation (block diagram only) & simple Applications)

TOTAL: 45 HOURS

REFERENCE

1. Bahl B.S.,Tuli G.D. and ArunBahl., Essential of Physical Chemistry, S.Chand& Co. Ltd., New Delhi.
2. Somorjai G.A., Introduction to surface chemistry and Catalysis, John Wiley & Sons Inc., New York.
3. Shaw D.J., Introduction to colloidal and surface Chemistry, Butterworth – Heinemann Publishers
4. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore.
5. Jain P.C. and Monika Jain, Engineering chemistry, Dhanpatrai Pub. Co. (P) Ltd., New Delhi.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical chemistry, ShobanLal Nagin Chand & Co., New Delhi

COURSE OUTCOMES

- Assemble a battery and illustrate the phenomenon of production of electric current
- Discuss the thermodynamic concepts and predict the feasibility of chemical reaction
- Apply the theory of adsorption in real life situations
- Outline the principles and instrumentation of spectroscopic techniques

U14CST101/ STRUCTURED PROGRAMMING USING C (Common to all branches of Engineering and Technology)	L	T	P	C
	3	1	0	4

OBJECTIVES

- To enable students to learn about the basics of computers and problem solving methods
- To learn the various features of C
- To learn how to program using C language

INTRODUCTION **9 Hours**

Programs and Programming- Programming languages and Their Classification - Compiler, Linker, Loader and Interpreter – Structured Programming Concept –Algorithm – Pseudo Code – Flow Chart.Number System – Binary – Decimal – Conversion Problems.

C LANGUAGE BASICS **9 Hours**

Introduction to C Programming – Fundamentals – Structure of a C Program – Compilation And Linking Processes – Constants, Variables – Data Types – Expressions Using Operators In C – Managing Input And Output Operations – Decision Making And Branching – Looping Statements – Solving Simple Scientific And Statistical Problems.

ARRAYS AND STRINGS **9 Hours**

Arrays – Initialization – Declaration – One Dimensional And Two Dimensional Arrays. String-String Operations – String Arrays. Simple Programs - Sorting- Searching – Matrix Operations.

FUNCTIONS, STORAGE CLASSES AND POINTERS **9 Hours**

Functions: Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion.

Storage classes – auto, static, extern, register- scope rules.

Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic memory allocation - Example Problems

STRUCTURES, UNIONS AND FILES **9 Hours**

Structures and Unions: Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions.

Files: Introduction – Using files in C - Working with text files.

L: 45 Hr, T: 15 Hr, TOTAL: 60 Hours

REFERENCES

1. Pradip Dey and Manas Ghosh, “Programming in C”, Second Edition, Oxford University Press, 2011.
2. Rajasekaran S, “Numerical methods in Science and Engineering-A practical approach”, S.Chand and Company, New Delhi-55, 2012.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
4. Byron S Gottfried and Jitendar Kumar Chhabra, “Programming with C”, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
5. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.

COURSE OUTCOMES

- Explain the basics of programs and programming
- Select appropriate data types and control structures for solving a given problem.
- Illustrate the representation of arrays, strings and usage of string operations.
- Illustrate the importance of pointers and dynamic memory allocation.
- Explain the basics of file handling mechanism.

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U14ME*T*101/ ENGINEERING GRAPHICS (Common to all branches of Engineering and Technology)	L	T	P	C
	2	0	3	3

OBJECTIVES

- To understand the principle of orthographic projection of points, lines, surfaces and solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.
- To study the principle of free-hand sketching techniques.

PLANE CURVES, PROJECTION OF POINTS AND LINES **15 Hours**

Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points.

Projections of straight lines located in first quadrant - determination of true length and true inclinations.

PROJECTIONS OF SURFACES AND SOLIDS **15 Hours**

Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane., Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **15 Hours**

Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

PICTORIAL PROJECTIONS **15 Hours**

Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms and pyramids when its base resting on the ground by vanishing point method.

FREE-HAND SKETCHING **15 Hours**

Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning.

Sketching pictorial views from given orthographic views.

L: 30 Hr, P: 45 Hr, TOTAL: 75 Hours

REFERENCES

1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.
2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.
3. Nataraajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
4. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
5. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.

COURSE OUTCOMES

- Construct various plane curves and projection of lines and surfaces.
- Develop projection of solids, sections of solids and surfaces.
- Apply the concepts of isometric, perspective and free hand sketching in engineering practice.

U14CH*P*101/ U14CH*P*201 CHEMISTRY LABORATORY	L	T	P	C
(Common to all branches of Engineering and Technology)	0	0	3	1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations

U14CS*P*101/ STRUCTURED PROGRAMMING LABORATORY USING C	L	T	P	C
(Common to all branches of Engineering and Technology)	0	0	3	1

OBJECTIVES

- To enable students to solve problems using C
- To apply the various features of C

LIST OF EXPERIMENTS

1. Simple programs
    - To find whether the given number is prime or not
    - Factorial of the given number
2. Programs involving Control and Looping Structures
    - Arithmetic Progression
    - Trigonometric series evaluation
3. Programs using Arrays
    - Sorting
    - Matrix addition and Multiplication
4. Calculation of median of a frequency distribution.
5. Evaluation of integrals
    - Trapezoidal Rule
6. String Processing
7. Program using Recursive function
8. Using pointers in C
9. Program using Functions, Structures and Files
    - Students Mark Analysis
10. Iterative method for finding Roots of the polynomials
    - Lagrange interpolation method

TOTAL: 45 HOURS

COURSE OUTCOMES

- ➢ Develop algorithms, flowcharts and programs to solve a given problem.
- ➢ Demonstrate code reusability using recursive and non-recursive functions.
- ➢ Implement pointers, memory allocation techniques and files in 'C' language.
- ➢ Apply and practice logical ability to solve simple problems.
- ➢ Demonstrate 'C' programs for statistical and scientific problem solving.

U14ME*P*101/ ENGINEERING PRACTICES LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

<u>LIST OF EXPERIMENTS</u>

GROUP – I **21 Hours**

A. CIVIL ENGINEERING

1. Carpentry

- Study of carpentry tools
- Preparation of T joint
- Preparation of dovetail joint

2. Plumbing

- Study of pipeline joints

B. MECHANICAL ENGINEERING

1. Fitting

- Study of fitting tools
- Preparation of L joint
- Preparation of square joint

2. Sheet Metal Working

- Study of sheet metal working tools
- Preparation of cone and tray

3. Welding

- Study of arc welding tools and equipment
- Preparation of butt joint

GROUP - II (ELECTRICAL & ELECTRONICS ENGINEERING)

C. ELECTRICAL ENGINEERING PRACTICE **12 Hours**

- Basic household wiring using switches, fuse, indicator-lamp, etc.,
- Preparation of wiring diagrams.
- Stair case light wiring.
- Tube light wiring
- Study of iron-box, fan with regulator, emergency lamp and microwave oven.

D. ELECTRONIC ENGINEERING PRACTICE **12 Hours**

1. Assembling simple electronic component on a small PCB and Testing.
2. Soldering simple electronic circuits and checking continuity.
3. Measurements using digital multimeter.
    - DC and AC voltage measurement
    - DC and AC current measurements.
    - Resistance Measurement.
    - Continuity measurement.
4. Testing of Electronic components
    - Resistors
    - Inductors and capacitors
    - Diodes (resistance in forward bias and reverse bias)
    - Transistors
5. Study of CRO and Function generator
    - Study of Panel Controls
    - Measurement of Amplitude, Frequency, phase difference

TOTAL: 45 HOURS

COURSE OUTCOMES

- Select the various tools and equipments used in the fabrication workshop.
- Develop various models in carpentry, fitting, sheet metal work and welding.
- Demonstrate and evaluate the parameters of basic electronic components (wires, resistors, capacitors, diodes etc.) and test the components.
- Estimate DC and AC Voltage and currents using appropriate measuring instruments.

U14GH*P*101/ PERSONAL VALUES (Common to all branches of Engineering and Technology)	L	T	P	C
	1	0	1	1

OBJECTIVE

- To inspire students to become best Humans.
- To know about self.
- To overcome evil temperaments.
- To live with sound health.
- To reach Intuition.

HUMAN LIFE & EXCELLENCE **4 Hours**

Human Excellence: Introduction – objective – personal values - importance.
Life : Self – Society – Nature – Yoga – purpose of life – philosophy of Human life.
Body, Soul, Mind & Their Functional Relationship : Panchboothas and it's association – Form of the body : physical body, astral body, causal body - Effect: Pain, Disease, Death; Soul – Life force – Bio magnetism – Genetic Centre – Mind : Origin & it's ten stages.

INTROSPECTION & THOUGHT ANALYSIS **4 Hours**

Introduction – Importance – Blemishes – Six evil temperaments & their maneuvering.
Thought analysis: Introduction - process of thought – Mind & Thought relationship – causes for origin of thoughts
Exercise: Training & Practice of Thought analysis

MORALIZATION OF DESIRE **2 Hours**

Desire : Introduction – Causes – Types – Contra qualities evolving out of desire – Effect of unfulfilled desire – Renunciation – Is attainment of desire in harmony with Law of Nature.
Training : Moralization of Desire.

NEUTRALIZATION OF ANGER **2 Hours**

Introduction – Origin of Anger – Alternative forms of Anger – A chain action – Consequence of anger on self & others – Neutralization of anger – the point where anger is won.
Training : Neutralizing anger.

ERADICATION OF WORRIES **2 Hours**

Worry: Causes - Effects – Types of problems – Solution to problems – Overcoming Worries.
Training – Eradication of Worries.

REALIZATION OF SELF **2 Hours**

Transformation Theory – Understating Self – Guru's role in guiding – Who am I? – Shaping One's destiny.
Training : Realization of self.

THEORY & PRACTICAL SESSION ON PHYSICAL EXERCISE: 9 Hours

Introduction – Hints & caution – Live in Health and harmony – Hand Exercise – Leg Exercise –Neuro muscular breathing Exercise – Kapalapathy – Magarasanas I & II – Massage – Acu-pressure – Body relaxation .

MEDITATION 5 Hours

Meditation: Agna Meditation – Shanthi Meditation.

Total: 30 Hours

COURSE OUTCOMES

- Acquire knowledge on the individual in relation to Nature and Society.
- Analysis purity of Thoughts, Moralization of Desire
- Learn about Neutralization of Anger.
- Develop skills in Sky yoga and Kaya kalpa.

B.E - AERONAUTICAL ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CH*T*202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14AE*T*201	Elements of Aeronautics	3	1	0	4
PRACTICAL					
U14CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14AE*P*201	CAD Laboratory - I	0	0	3	1
U14GH*P*201	Human Excellence – Family Values	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDIT – 25**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MAT201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition, 2010.
4. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
5. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
6. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
7. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

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U14PH*T*202/ MATERIALS SCIENCE	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes –

fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIALS **9 Hours**

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005
3. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007
4. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd, 2004
5. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications

U14CH*T*202/ APPLIED CHEMISTRY	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	3	0	0	3

OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION **9 Hours**

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS **9 Hours**

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE **9 Hours**

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY **9 Hours**

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).
Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY **9 Hours**
Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

1. Samir Sarkar, Fuels and Combustion, Orient Longman, India.
2. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore.
3. Derek Pletcher and Frank C Walsh, Industrial Electrochemistry, Blackie Academic and Professional, London.
1. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi
2. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi.

COURSE OUTCOMES
- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder

U14ME*T*201/ ENGINEERING MECHANICS	L	T	P	C
(Common to CE, AUE, AE, ME, MCE & TXT)	3	1	0	4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES **9 Hours**

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES **9 Hours**

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS **9 Hours**

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION **9 Hours**

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES **9 Hours**

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.

3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.

U14AET201/ ELEMENTS OF AERONAUTICS	L	T	P	C
(For Aeronautical Engineering)	3	1	0	4

OBJECTIVES

- To promote an understanding of the aeronautical field and a higher level of motivation among students by providing an overall perspective before they begin their more specialized courses. A broad base is developed into which subsequent courses can be integrated in depth.

INTRODUCTION TO AIRPLANES **9 Hours**

Introduction, historical background, Different types of flight vehicles, Components of an airplane and their functions. Conventional control, Basic instruments for flying.
Physical properties and structure of the atmosphere, (Temperature, Pressure and altitude relationships), Evolution of lift, Drag and moment. Aero foils, Avionics: Flight deck and cockpit.

AIRPLANE STRUCTURES AND MATERIALS **9 Hours**

Introduction to structural design of Aircraft and spacecraft, flight loads, general types of construction, Monocoque, Semi-monocoque and composite structure construction, Typical wing and fuselage structure, Metallic and Non metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials in aerospace.

AIRCRAFT ENGINES **9 Hours**

Selection of power plants: piston, turbo-propeller, turbofan, and jet engines with after burner / thrust augmentation thrust vector control, FADEC. Use of propeller and jets for thrust production, Comparative merits. Theory of Propellers.

SPACE SYSTEM DESIGN **9 Hours**

Overview on space environment, introduction to space debris, Launch site selection, Brief introduction to rockets, ramjet, and SCRAMJET, Thrust vector control mechanisms, staging of rockets, space mission, re-entry vehicles, life support systems for manned space missions, Fuel cells, Introduction to space mechanics: Kepler’s laws of planetary motion, introduction to satellites, Interplanetary missions, Space exploration.

ROTORCRAFT, UAVs, AND AIRCRAFT SYSTEMS **9 Hours**

Introduction to Helicopters and Micro-lights. Introduction to UAVs and MAVs. Types and applications, Maintenance, safety and operations. Basic principles and lay out of various aircraft systems: Hydraulic system, Aircraft Fuel system, Engine fuel system, Air conditioning and Pressurization system Flight control system, Navigation and Weapon control system, Under carriage and Brake system, High lift devices.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1 Dava Newman, Interactive Aerospace Engineering and Design, McGraw-Hill.
2 John Cutler & Jeremy Liber, Understanding Aircraft Structures, 4th edition, Sheridan House Inc.
3 Austin R., Unmanned Aircraft Systems, AIAA Education Series, 2010.
4 FAA-H-8083-25A, Pilot's Handbook of Aeronautical Knowledge, FAA, DOT, USA.
5 Anderson J.D., Introduction to Flight, McGraw-Hill 7th edition, 2013.
6 George P. Sutton and Oscar Biblarz, Rocket Propulsion Elements, 7th edition, John Wiley & Sons, Inc., New York, 2001.
7 Jack D.Mattingly, "Elements of *Propulsion*: *Gas Turbines* and Rockets", 2nd Edition.

COURSE OUTCOMES

- To provide students with an introduction to the aerospace field.
- To teach students about the fundamentals of vehicle flight in the atmosphere
- To teach students about the fundamentals of vehicle flight in space
- To provide students with an understanding of performance
- To provide students with engineering background suitable for subsequent course work in aerospace engineering.

U14CH*P*101/ U14CH*P*201 CHEMISTRY LABORATORY	L	T	P	C
(Common to all branches of Engineering and Technology)	0	0	3	1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14AE*P*201 - CAD LAB – I	L	T	P	C
(For Aeronautical Engineering)	**0**	**0**	**3**	**1**

OBJECTIVES

- To introduce the concept of 2-D drafting using CAD packages.

LIST OF EXERCISES

1. Study of drafting software.
2. Development of Part drawing for Simple components.
3. Development of Isometric drawing for Simple components.
4. Development of Assembled drawing for Screw Jack.
5. Development of Assembled drawing for Landing Gear.
6. Development of Part drawing for Wing Structure components.
7. Development of t Part drawing for Fuselage structure components.
8. Development of three view diagram of a typical Helicopter.
9. Development of three view diagram of a typical Aircraft.

TOTAL: 45 HOURS

List of Tools required

- Drafting & modeling software (Like AUTOCAD)

COURSE OUTCOMES

- Use the AutoCAD software program to create drawings from scratch and to modify, manipulate, copy, delete, save, and plot drawings.
- Use the full range of AutoCAD commands and options and employ shortcuts and time-saving strategies to operate the program at a level of efficiency acceptable for employment as a CAD Engineer.
- Create, render, and manipulate 3D AutoCAD drawings and convert 2D drawings to 3D drawings.
- Identify or roughly define the terms, concepts, and standards associated with the topics of the course.
- Report to a workplace regularly and punctually, engage effectively and congenially with peers and supervisors, work from written as well as oral instructions, use assigned time efficiently for productive work, and meet production deadlines.
- Demonstrate graphical and computational problem-solving skills appropriate to the level of the coursework.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA **4 Hours**

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E – AUTOMOBILE ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CH*T*202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14EE*T* 211	Basics of Electrical and Electronics Engineering	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14AU*P*201	CAD Laboratory	0	0	3	1
U14EE*P*211	Basics of Electrical and Electronics Engineering Lab	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	**2**	**0**	**2**	**3**

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES
OBJECTIVES
On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4. Singapore, 10th Edition, 2010.
5. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PH*T*202/ MATERIALS SCIENCE	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin’s theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes –

fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIALS **9 Hours**

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005
3. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007
4. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd, 2004
5. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications

U14CHT202/ APPLIED CHEMISTRY	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	3	0	0	3

OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION **9 Hours**

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS **9 Hours**

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE **9 Hours**

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY **9 Hours**

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).
Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY **9 Hours**
Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

1. Samir Sarkar, Fuels and Combustion, Orient Longman, India.
2. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore.
3. Derek Pletcher and Frank C Walsh, Industrial Electrochemistry, Blackie Academic and Professional, London.
3. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi
4. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi.

COURSE OUTCOMES
- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder

U14ME*T*201/ ENGINEERING MECHANICS	L	T	P	C
(Common to CE, AUE, AE, ME, MCE & TXT)	3	1	0	4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES **9 Hours**

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES **9 Hours**

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS **9 Hours**

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION **9 Hours**

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES **9 Hours**

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.

Solve problems using the concepts in kinematics and kinetics

U14EET211/ BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
(For Mechanical, Automobile& Biotechnology)	3	0	0	3

OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDEMENTALS 9 Hours

Electric current and Ohm's law – Resistance and Resistivity – Relation between Voltages, Current, Resistance and Power - Capacitance – Parallel plate capacitor – Energy stored in a capacitor.

ELECTROMAGNETISM 9 Hours

Magnetic field - Field intensity, magnetic flux , Flux density – Permeability – Magnetic effects of electric current – Magnetic circuit – Faraday's laws of Electromagnetic Induction – Self-inductance and Mutual inductance – Energy stored in magnetic field – Magnetic Hysteresis.

AC-CIRCUITS 9 Hours

Alternating voltages and current – Sinusoidal waveform – cycle and frequency – RMS value – vector diagram of sine waves of same frequency – Alternating current through Resistance, Inductance and Capacitance – current through series circuits – Power factor – Active and Reactive power – Generation of three phase voltage – Voltages, Currents and Power in Star and Delta connected loads.

ELECTRICAL MACHINES (Qualitative Treatment Only) 9 Hours

DC motor – Principle of operation – Back-emf and voltage equation – Torque and speed Characteristics of Series and Shunt connected motors – Transformer – Ideal Transformer relationship – Three phase induction motor – Cage rotor and Wound rotor – Principle of operation – Slip – Torque Slip characteristics – Single phase induction motors.

ELECTRONIC CIRCUITS 9 Hours

Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS

REFERENCES

1. Thomas L Floyd, Electronic Devices, 6th edition, Pearson Education, 2003.
2. Muthusubramanian R., Salivahanan S. and Muraleedharan. K.A., Basic Electrical Electronics and Computer Engineering, Tata Mcgraw Hill, 2nd edition, 2006.
3. Thyagarajan T., Sendur Chelvi K.P. and Rangaswamy T.R., Engineering Basics, Revised 2nd edition, New Age International Pvt. Ltd.
4. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand Publishing, 2012.

COURSE OUTCOMES

- Acquire the knowledge of fundamental laws of electrical and electronics engineering.
- State the definition of magnetic circuits.
- Choose suitable motor for desired application.
- The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
- The learners can verify the truth table of digital logic gates.

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations

U14 AU*P* 201/ CAD LABORATORY	L	T	P	C
	0	0	3	1

LIST OF EXPERIMENTS

1. Introduction to CAD Commands
2. Creation of simple objects
3. Special curves
4. Projection & Section of simple solids
5. Orthographic views of solids
6. Isometric views of objects
7. Simple trusses
8. 3D modeling of simple solids
9. 2D multiple views from 3D model

TOTAL: 45 HOURS

COURSE OUTCOMES

- Draw 2D and 3D drawings using drafting software
- Convert orthographic view into isometric view
- Become familiar to draw Special curves

U14EEP211/ BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	L	T	P	C
(For Automobile Engineering)	0	0	3	1

AIM

To provide experimental skill in the operation of DC, AC machines and Hands on experience in the development of electronic circuits.

OBJECTIVES

- To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
- To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS

1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 HOURS

COURSE OUTCOMES

- The Students will gain the basic knowledge and understanding the concept of AC and DC machines.
- Students will know the working principle, performance characteristics, (Torque, Speed, Efficiency) control and applications of Electrical Machines.
- Students will be able to design and conduct performance experiments in machines and Rectifiers.
- To familiarize the starting methods of all rotating machines.
- Students will be exposed to the practical applications of identify and solve machines related problems.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	**1**	**0**	**1**	**1**

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA **4 Hours**

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

SEMESTER – II

Code No.	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*206	Applied Physics	3	0	0	3
U14CH*T*205	Chemistry for Biotechnology	3	0	0	3
U14EET211	Basics of Electrical and Electronics Engineering	3	0	0	3
U14BT*T*201	Biomolecules and Genetics	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14BT*P*201	Biomolecules and Genetics Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 31 HOURS **TOTAL CREDITS – 23**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY 15 Hours

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING 15 Hours

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY 15 Hours

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY 15 Hours

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1 Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2 Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3 Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4 Singapore, 10th Edition, 2010.
5 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PH*T*206/ APPLIED PHYSICS	L	T	P	C
(For Biotechnology)	3	0	0	3

OBJECTIVES

At the end of the course the students would be exposed to

- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.
- Application of ultrasonic and nuclear physics in medicine.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials: Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials: Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy,magnetic disc drives – Bubble memory.

Dielectric materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes –

fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

MEDICAL PHYSICS **9 Hours**

Ultrasound picture of human body – Block diagram of basic pulse Echo system – A Scan – B scan & M Scan Phsychological effect - ultrasound therapy – Phonocardiograph (PCG) source of radioactivity for nuclear medicine - statistical aspects – Basic instrumentation (Geiger Muller counter, Photo multiplier Tube & Scintillation detector (Renogram) and its clinical applications (Thyroid and Kidney function) – Nuclear medicine imaging devices - Gamma Camera - Positron camera.

TOTAL: 45 HOURS

REFERENCE BOOKS

1. Rajendran V., Engineering Physics, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2011.
2. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
3. Ali Omar M., Elementary Solid State Physics, Pearson Education (Singapore), Indian Branch, New Delhi, 2002.
4. Palanisamy P.K., Materials Science, 2nd Edition, Scitech Pub. India, Pvt., Ltd., Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
5. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005 (Units: 1,2,3,4).
6. Arumugam M., Physics-II (For Civil, Chemical, Textile, Biotechnology, Polymer and Fashion technology), Anuradha agencies, Kumbakonam, 2005 (Units: 5).

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Sketch the skills and techniques for biotechnological and medical applications

U14CHY205 CHEMISTRY FOR BIOTECHNOLOGY	L	T	P	C
(For Biotechnology)	3	0	0	3

OBJECTIVES

- To correlate theoretical principles with application oriented studies
- To inculcate a basic foundation in stereochemistry of Biomolecules
- To embellish the usage of chemistry to exhibit engineering and technical concepts by presenting a overview on theoretical and modern technological aspects in polymers, water technology and biomolecular analysis as required for the Bio technology students.

CHEMICAL BONDING IN BIOMOLECULES **9 Hours**

Ionic, covalent and co-ordinate covalent bonds (overview only), hybridization (sp, sp^2, sp^3, sp^3d, sp^3d^2 in simple molecules), hydrogen bonding and its consequences, Van der Waal's forces (dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions) - dipole moment (applications).

INTRODUCTION TO STEREOCHEMISTRY **9 Hours**

Isomerism : Introduction and classification of isomerism.

Structural isomerism : Definition, chain, position, functional, mesomerism, tautomerism, Conformational isomerism in simple organic molecules

Notation : d and l; R and S ; E and Z notation of simple organic molecules

Configurational isomerism or geometrical isomerism: definition – in alkenes and cyclopropanes

Optical isomerism : Definition and conditions of optical isomerism - Optical activity – Chirality – Optical isomerism in tartaric and lactic acids - optical activity without asymmetric carbon (allelenes, Biphenyl derivatives) – definition of Enantiomers, diastereomers, Mesocompounds, racemic mixture, asymmetric synthesis – Walden inversion

WATER TECHNOLOGY **9 Hours**

Disadvantages of raw water in industries – conditioning methods : external treatment methods (ion exchange method), internal treatment (colloidal, phosphate, calgon and carbonate methods) – desalination (reverse osmosis and electrophoresis) – Treatment of sewage water.

CHEMISTRY OF POLYMERS **9 Hours**

Introduction - classification based on source, application, thermal properties (thermosetting and thermoplastics) - effect of polymer structure on properties – types of polymerization (addition, condensation, co-polymerization and Ring polymerisation) - mechanism of polymerization (free radical mechanism and coordination mechanism - monometallic)

Bio Polymers and its applications : Cellulose, Starch, Collagen, Lignins and Chitosins

QUANTITATIVE ANALYSIS **9 Hours**

Determination of the amount of calcium in milk powder by EDTA Complexometry - Estimation of iodine in iodized common salt by Iodometry - Estimation of phosphoric acid in soft drinks (coca cola) by molybdenum blue method - Synthesis of fluorescein, and its use in angiogram techniques - Super absorbent polymers : preparation, properties and uses

TOTAL: 45 HOURS

REFERENCES

1. Finar I.L., Organic chemistry, Publishing house, UK.
2. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, Blackwell Publishing, London.
3. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi.
4. Seymour R.B. and Carraher, Polymer Chemistry, Plenum publishing corporation, New york,
5. Syed Shabudeen P.S. and Shoba U.S., Chemistry for Textiles, Inder publications, Coimbatore
6. Amarika Singh, Vairam S., and Suba Ramesh, Chemistry for Engineers, Wiley India ltd., New Delhi
7. Bahl B.S. and Arun Bahl, A Textbook Of Organic Chemistry, S. Chand & Co., New Delhi

COURSE OUTCOMES

- Outline basic concepts of stereochemistry
- Discuss the mechanism of polymer formation
- Paraphrase an experiment in required sequence
- Design a waste water purifier

U14EE*T*211/ BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
(For Mechanical, Automobile& Biotechnology)	3	0	0	3

OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDEMENTALS **9 Hours**

Electric current and Ohm's law – Resistance and Resistivity – Relation between Voltages, Current, Resistance and Power - Capacitance – Parallel plate capacitor – Energy stored in a capacitor.

ELECTROMAGNETISM **9 Hours**

Magnetic field - Field intensity, magnetic flux , Flux density – Permeability – Magnetic effects of electric current – Magnetic circuit – Faraday's laws of Electromagnetic Induction – Self-inductance and Mutual inductance – Energy stored in magnetic field – Magnetic Hysteresis.

AC-CIRCUITS **9 Hours**

Alternating voltages and current – Sinusoidal waveform – cycle and frequency – RMS value – vector diagram of sine waves of same frequency – Alternating current through Resistance, Inductance and Capacitance – current through series circuits – Power factor – Active and Reactive power – Generation of three phase voltage – Voltages, Currents and Power in Star and Delta connected loads.

ELECTRICAL MACHINES (Qualitative Treatment Only) **9 Hours**

DC motor – Principle of operation – Back-emf and voltage equation – Torque and speed Characteristics of Series and Shunt connected motors – Transformer – Ideal Transformer relationship – Three phase induction motor – Cage rotor and Wound rotor – Principle of operation – Slip – Torque Slip characteristics – Single phase induction motors.

ELECTRONIC CIRCUITS **9 Hours**

Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS

REFERENCES

1. Thomas L Floyd, Electronic Devices, 6th edition, Pearson Education, 2003.
2. Muthusubramanian R., Salivahanan S. and Muraleedharan. K.A., Basic Electrical Electronics and Computer Engineering, Tata Mcgraw Hill, 2nd edition, 2006.
3. Thyagarajan T., Sendur Chelvi K.P. and Rangaswamy T.R., Engineering Basics, Revised 2nd edition, New Age International Pvt. Ltd.
4. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand Publishing, 2012.

COURSE OUTCOMES

- Acquire the knowledge of fundamental laws of electrical and electronics engineering.
- State the definition of magnetic circuits.
- Choose suitable motor for desired application.
- The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
- The learners can verify the truth table of digital logic gates.

U14BT*T*201/ BIOMOLECULES AND GENETICS	L	T	P	C
(For Biotechnology)	**3**	**0**	**0**	**3**

OBJECTIVES

- To expose the students to the area of biochemistry/cell biology and basic genetics. This knowledge is required to understand Biochemistry, molecular biology and genetic engineering.

CARBOHYDRATES **9 Hours**

Definition; Carbohydrates-; Classification- Monosaccharides - Structure, and function, Disaccharides- Structure and function- Sucrose, Lactose, Polysaccharides- Starch, cellulose, heparin, hyaluronic acid.

LIPIDS **9 Hours**

Definition: Classification of lipids- Simple lipids -Physical and chemical properties of fats. Saponification number; Compound lipids-Structure and function of phospholipids and Glycolipids. Fatty acids (C16, C18) - Saturated and unsaturated fatty acids; Essential fatty acids. Steroids : Cholesterol Structure and functions.

AMINO ACIDS, PEPTIDES, VITAMINS AND MINERALS **9 Hours**

Amino acid- Definition, Structure and classification; Essential amino acids; Peptides-Definition, Structure and properties. Vitamins- Definition, Structure; Physiological functions of fat and water soluble vitamins. Minerals - Essential macro and micro minerals, sources and functions.

CLASSICAL GENETICS **9 Hours**

Mendelian genetics- Introduction, Principles; Monohybrid, Dihybrid and Trihybrid crosses; Backcross and testcross; Linkage, Crossing over, Genetic mapping, recombination; Multiple alleles- Blood group antigens.

CHROMOSOME STRUCTURE AND ORGANIZATION **9 Hours**

Nucleic acids: structure of DNA, RNA; Chromosome organization of eukaryotes. Ploidy-polyploidy and Aneuploidy; Human karyotypes; Human sex Chromosome-linked disorders - Hemophilia, Fragile X; Special chromosomes - Polytene chromosomes and Lamp Brush chromosome.

TOTAL: 45 HOURS

REFERENCES

1. Enger, Concepts in Biology, Tata McGraw-Hill Publ., 11^{th} Edition, 2005.
2. Gardner E.J., Simmons M.J.and Slustad D.P., Principles of Genetics, 8^{th} Edition, Wiley Publishers, 1999.
3. McKee E. and McKee T., Biochemistry – an Introduction, Win. C. Brown Publ., 1996.
4. Soper R, Taylor DJ., Green NPO., Stout GW.(1998) "*Biological Science*" 3rd Edition. Cambridge Univ Press.

COURSE OUTCOMES

- Draw the structure and explain the classification and functions of carbohydrates
- Describe the structure and functions of lipids, and cholesterol
- Classify and discuss the properties and functions of amino acids, vitamins and minerals
- Recall the concepts of mendelian genetics and multiple allelism
- Understand and explain the structure of chromosomes and related disorders

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    a. Addition of two images
    b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14BTP201/ BIOMOLECULES AND GENETICS LABORATORY	L	T	P	C
(For Biotechnology)	0	0	3	1

OBJECTIVES

- To teach basic skills required for analysis of biomolecules such as carbohydrates, proteins, lipids, etc.
- To enable the student to perform simple experiments in Genetics.

LIST OF EXPERIMENTS

1. Qualitative analysis of Carbohydrates (glucose, galactose, fructose, maltose, sucrose and starch)
2. Qualitative analysis of amino acids (tyrosine, tryptophan, methionine, alanine and proline)
3. Qualitative analysis of lipids (general lipids)
4. Qualitative analysis of Proteins (simple and glycoproteins)
5. Qualitative analysis of minerals.
6. Blood grouping
7. Isolation of starch from potato
8. Identification of mitotic stages in onion root tip
9. Identification of polytene chromosomes
10. Genetic Mapping (Problems to be worked out)

TOTAL 45 HOURS

REFERENCES

1. Shanmugam S and Sathishkumar T. Complete Laboratory Handbook on Engineering Biotechnology and Life Sciences, 1st Edition, India: Inder Publishers, 2009.

COURSE OUTCOMES

- Ability to perform experiments for qualitative analysis of biomolecules.
- Ability to carry out simple experiments related to Cell Biology and Genetics

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA **4 Hours**

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E CIVIL ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics II	3	1	0	4
U14PH*T*201	Materials Science	3	0	0	3
U14CH*T*201	Chemistry for Civil Engineering	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14CE*T*201	Construction Materials	3	0	0	3
PRACTICAL					
U14 CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14CE*P*201	Construction Materials Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	**2**	**0**	**2**	**3**

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – “Wh” questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	**3**	**1**	**0**	**4**

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1 Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2 Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3 Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4 Singapore, 10th Edition, 2010.
5 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

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U14PH*T*201 / MATERIALS SCIENCE	L	T	P	C
(For Civil Engineering)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in

- Design of acoustically good buildings
- Properties and applications of conducting materials, Superconducting materials, magnetic and dielectric materials.
- Preparation, properties and applications of Metallic glasses, Shape memory alloys and Nano materials.

ACOUSTICS **9 Hours**

Classification of sound – characteristics of musical sound –loudness –Weber-Fechner law – decibel, phon – Reverberation – reverberation time – derivation of Sabines formula for reverberation time (rate of growth and rate of decay) –Absorption coefficient and its determination – factors affecting acoustics of buildings –optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise and their remedies –sound absorbing materials –noise pollution – noise control in machines.

CONDUCTING AND SUPERCONDUCTING MATERIALS **9 Hours**

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS **9 Hours**

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap of a semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS **9 Hours**

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronics, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : Synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

TOTAL: 45 HOURS

REFERENCE BOOKS

1. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
2. Palanisamy P.K., Materials Science, 2nd Edition, Scitech Pub. India, Pvt. Ltd., Chennai, 2003.
3. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
4. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
5. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2005
6. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd., 2004

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Describe the impact of acoustic engineering solutions in a constructional environmental, and societal context
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.

U14CHT201/ CHEMISTRY FOR CIVIL ENGINEERING	L	T	P	C
(For Civil Engineering)	3	0	0	3

OBJECTIVES

- To impart a sound knowledge of theoretical and modern technological aspects of, water technology, corrosion studies and specialty engineering materials as required for the civil engineers.

WATER TECHNOLOGY **9 Hours**

Water hardness - Boiler feed water - boiler corrosion - priming and foaming - formation of deposits in steam boilers and heat exchangers – caustic embrittlement - disadvantages (wastage of fuel, decrease in efficiency, boiler explosion) - prevention of scale formation : Internal treatment (phosphate, calgon, carbonate, colloidal), external treatment (ion exchange method) - desalination by reverse osmosis - Treatment of common effluents.

CORROSION SCIENCE **9 Hours**

Corrosion : principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion : galvanic corrosion, differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) , stress corrosion

Corrosion control : cathodic protection (sacrificial anode) - electroplating (Copper plating).

ENGINEERING MATERIALS **9 Hours**

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity thermal spalling) - general manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks only.

Lubricants: functions - classification with examples - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) – greases (calcium based, sodium based, lithium based only) - solid lubricants (graphite, molybdenum sulphide).

CHEMISTRY OF CONSTRUCTION MATERIALS **9 Hours**

Cement : Chemical composition – setting and hardening — special cements (high alumina cement, sorel cement, white Portland cement, water proof cement).

Paint : constituents – functions – special paints (fire retardant, water repellant, temperature indicating and luminous paints) - Varnishes and lacquers

COMPOSITE MATERIALS **9 Hours**

Composites: definition – characteristics – constituents – types: properties and applications of fibre reinforced plastic (FRP), metal matrix composites (MMC), ceramic matrix composites (CMC), Engineered cementitious composites (ECC), Natural fiber reinforced composite

Engineering Plastics : Preparation (mechanism not required) and applications of polyamide, polycarbonates, polyurethanes and thermocole - polymer blends and alloys

TOTAL: 45 HOURS

REFERENCES

1. Rangwala, Engineering Materials, Charator Publishing House, India.
2. Jain P.C. and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing company (P) Ltd, New Delhi, National Building Code – 2002.
3. Rajput R.K., Engineeing Materials, S. Chand & Company Ltd., New Delhi.
4. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore .
5. Dara S.S., A Textbook of Engineering Chemistry, S. Chand & Company Ltd., New Delhi
6. Kenneth G. Butinski, Engineering Material, Prentice – Hall of India, New Delhi

COURSE OUTCOMES

- Design a water purifier**.**
- Defend the Corrosion problems
- Identify the different construction materials and their constituents
- Describe the impact of composite materials and engineering plastics in construction
- Categorize the engineering materials and their uses .

U14ME*T*201/ ENGINEERING MECHANICS	L	T	P	C
(Common to CE, AUE, AE, ME, MCE & TXT)	3	1	0	4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES **9 Hours**

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES **9 Hours**

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS **9 Hours**

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION **9 Hours**

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES **9 Hours**

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.

3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.

U14CE*T*201/ CONSTRUCTION MATERIALS	L	T	P	C
(For Civil Engineering)	3	0	0	3

OBJECTIVES

- At the end of this course the student should have learnt about the various materials, both conventional and modern, that are commonly used in Civil Engineering construction. Further he should be able to appreciate the criteria for choice of the appropriate material and the various tests for quality control in the use of these materials.

STONES-BRICKS-CONCRETE BLOCKS **9 Hours**

Stone as building material-Criteria for selection-Tests on stones-Deterioration and preservation of stone work-Bricks-Classification- Manufacture of clay bricks-Tests on bricks-Compressive strength-Water absorption-Efflorescence –Bricks for special use-Refractory bricks-cement and concrete hollow blocks-Light weight concrete blocks-Code Practices.

LIME-CEMENT-AGGREGATES-MORTAR **9 Hours**

Lime-preparation of lime mortar-Cement-Ingredients-Manufacturing process-Types and Grades-Properties of cement and cement mortar- Hydration-Compressive strength-Tensile strength-Soundness and consistency-Setting time- Aggregates-Natural stone aggregates-Industrial byproducts-Crushing strength-Impact strength-Flakiness-Abrasion resistance-Grading-sand-Bulking-Code practices.

CONCRETE **9 Hours**

Concrete-ingredients-Manufacture-Batching plants-RMC-Propertie of fresh concrete- slump-flow and compaction-Properties of hardened concrete- Compressive, Tensile and shear strength- Modulus of rupture- Tests- Mix specification- Mix proportioning-IS method- High strength concrete and HPC- Other types of concrete-Code Practices.

TIMBER AND OTHER MATERIALS **9 Hours**

Timber- Market forms-Industrial timber-Plywood-veneer-Thermocole-Panels of laminates-Steel-Aluminium and other metallic materials-Composition-uses-market forms-Thermomechanical treatment-Paints- Varnishes-Distempers-Coe Practices.

MODERN MATERIALS **9 Hours**

Glass-Ceramics-Sealants for joints- Fibre glass and metal reinforced plastic-clay products-Refractories-Composite materials –Types-Applications of laminar composites- Fibre textiles-Geosynthetics for Civil Engineering Applications- Flyash.

TOTAL: 45 HOURS

REFERENCES

1. Varghese P.C., Building Materials, PHI Learning Pvt. Ltd., 2005.
2. Rangwala S.C., Engineering materials, Charotar Publishing House, 2008.
3. Premalatha J., Building materials, Inder Publications, 2010.
4. Shetty M.S., Concrete Technology (Theory and Practice), S. Chand & Co Ltd.
5. Rajput R.K., Engineering materials, S. Chand & Company Ltd., 2000.
6. Duggal S.K., Building Materials, New Age International (P) Ltd., 2009.

COURSE OUTCOMES

- Compare the properties of most common and advanced building materials.
- Understand the typical and potential applications of these materials
- Understand the quality test procedures for various materials
- Know about the structural forms of various materials
- Acquire knowledge on advanced materials used in civil engineering field.

U14CH*P*101/ U14CH*P*201 CHEMISTRY LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

4. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
5. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
6. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    a. Addition of two images
    b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

<table>
<tr><td>U14CEP201/ CONSTRUCTION MATERIALS LABORATORY</td><td rowspan="2"><table><tr><td>L</td><td>T</td><td>P</td><td>C</td></tr><tr><td>0</td><td>0</td><td>3</td><td>1</td></tr></table></td></tr>
<tr><td>(For Civil Engineering)</td></tr>
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LIST OF EXPERIMENTS

1. Tests on Aggregate
2. Moisture Content of Concrete Aggregate"
3. Specific Gravity and Absorption of Coarse Aggregate
4. Specific Gravity and Absorption of fine Aggregate"
5. Resistance to Degradation of Small-size coarse Aggregate by Abrasion in the Los Angeles Machine
6. Aggregate crushing strength test
7. Abrasion test
8. Shape Test (Flakiness Index)
9. Shape test (Elongation Index)
10. Shape Test (Angularitv Number)
11. Unit Weight and Voids in Aggregate in its compacted or loose condition"
12. Sieve analysis of fine and coarse aggregate

Tests on Cement

1. Blaine's Air Permeability test
2. Fineness of Hydraulic Cement by No.100 or No. 200 Sieve"
3. Normal Consistency of Hydraulic Cement"
4. Initial and Final Time of Setting of Cement"
5. Density and Specific Gravity of cement"
6. Compressive Strength of Hydraulic Cement Mortars"
7. Tensile Strength of Cement Mortar
8. Compressive strength of brick
9. Strength tests on Flooring tiles

TOTAL: 45 HOURS

COURSE OUTCOMES

- Find the physical and mechanical properties of construction materials like cement, sand and aggregates by conducting various laboratory tests.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	**1**	**0**	**1**	**1**

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S 4 Hours

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E - COMPUTER SCIENCE AND ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14EE*T*212	Electrical and Electronic Circuits	3	1	0	4
U14IT*T*201	Foundations of Information Technology	3	0	0	3
U14CS*T*201	Digital Systems and Design	3	1	0	4
	PRACTICAL				
U14EE*P*212	Electrical and Electronic Circuits Laboratory	0	0	3	1
U14CS*P*201	Computer Hardware Lab	0	0	3	1
U14CS*P*202	Digital Systems and Design Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDITS – 25**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 9 Hours

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS 9 Hours

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 9 Hours

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION 9 Hours

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4. Singapore, 10th Edition, 2010.
5. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

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U14PHT203 / MATERIALS SCIENCE	L	T	P	C
(Common to ECE, EIE, CSE & IT)	3	0	0	3

OBJECTIVES

At end of the course students would be exposed to

- Conducting, super conducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducters: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory .

Dielectric Materials: Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

OPTICAL MATERIALS **9 Hours**

Optical properties of semiconductors – Excitons- Traps – colour centre – Types of colour centres – luminescence – fluorescence and phosphorescence - liquid crystal display – Dynamics scattering display – Twisted nematic crystal display – Non- linear materials – second harmonic generation – optical mixing – optical phase conjugation.

TOTAL: 45 HOURS

REFERENCES

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003
2. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
3. Palanisamy P.K., Materials Science, 2nd edition, Scitech Pub. India, (P) Ltd., Chennai, 2003.
4. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003 (Units: 1,2).
5. Rajendran V., Marikaniv A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd., 2004 (Units: 3,4,5).

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications

U14EE*T*212/ ELECTRICAL AND ELECTRONIC CIRCUITS	L	T	P	C
(Common to CSE & IT)	3	1	0	4

OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

DC CIRCUITS **9 Hours**

Electrical quantities – SI units – Circuit elements – Ohm's law – Kirchoff's laws – DC series and parallel circuits – Mesh and nodal analysis – Star to delta conversions – Simple problems.

AC CIRCUITS **9 Hours**

Sinusoidal excitation – RMS , Average and Peak values – Phasor representation – Power factor – Single phase RC,RL and RLC circuits – Series and Parallel resonance – Introduction to three phase circuits: V, I and P equations – Simple problems.

SEMICONDUCTOR DIODE AND APPLICATIONS **9 Hours**

N and P type semiconductors – PN junction – Biasing – VI characteristics – Diode operation – Rectifiers – Half wave, Full wave , Bridge rectifiers – Power supply filters – Zener diode – Applications – Optical diode.

TRANSISTORS AND APPLICATIONS **9 Hours**

Transistors – Operation, Characteristics, Biasing – BJT amplifiers – CE – CB – CC – Multistage amplifiers – JFET, MOSFET – Characteristics, Biasing – SCR – Phototransistor.

OSCILLATORS AND OPERATIONAL AMPLIFIERS **9 Hours**

Principle of oscillators – RC feedback Circuits – LC feedback circuits – Relaxation oscillators – Introduction to Operational Amplifiers – Input modes and Op- amp parameters – Op-amp with negative feedback – Comparator – Summing amplifier – Integrator and Differentiator.

L: 45 Hr T: 15 Hr TOTAL: 60 HOURS

REFERENCES

1. Edminister and Nahvi, Electronic Circuits, Schaum's outlines, Tata MCGraw – Hill, 1999.
2. Robert L. Boylested and Louis Nahelsky, Electronic Devices & Circuit theory, 7th Edition, Prentice Hall, 1999.
3. Choudhury R. and Jain S., Linear Integrated Circuits, 3rd edition, New Age Pub., 2007.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2004.

5. Muthusubramaniam R., Salivahanan S. and Muraleedharan K.A., Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2nd edition, 2006
6. Thomas L. Floyd, Electronic Devices, 6th edition, Pearson Education, 2003

COURSE OUTCOMES

- Define & identify the basic electrical quantities and also able to calculate approximately the voltage, current parameters in DC circuits using basic laws.
- Understand the phasor representation of various AC circuit parameters and acquire knowledge on fundamentals of three phase ac circuits.
- Differentiate the various semiconductor diodes and rectifiers
- Summarize the characteristics of different types of transistors.
- Apply the achieved basic knowledge about oscillators & op-amp to different dc applications.

U14ITT201/ FOUNDATIONS OF INFORMATION TECHNOLOGY	L	T	P	C
(Common to CSE & IT)	3	0	0	3

OBJECTIVES

- Acquire an overview of data storage and manipulation in computers
- Understand the basic concepts of operating systems , networks and database
- Know the applications of Internet and Information Technology

Computer Basics and Architecture **11 Hours**

Computer Organization and Architecture: Introduction-CPU-Communication among various units - Instruction Format-Instruction Cycle-Instruction Set-Data Representation in Computers.
Computer Memory and Storage: Memory Hierarchy-Types of Memory-CPU interaction with memory-Secondary Storage devices and its types

Basics of Operating Systems and Databases **10 Hours**

Operating systems: Evolution-Types of Operating System –Functions of Operating System-Coordinating machine activities-Handling competition among processes
Database Fundamentals: Logical and Physical Data Concepts- Database Management System-Architecture-Database Models-Types of databases.

Basics of Networks and Data Communication **08 Hours**

Networks-Network Topologies-Communication Protocol-Network devices
Data Communication: Introduction-Data Communication-Transmission Media-Modulation-Multiplexing-Switching

Basics of Data abstraction and Software Engineering **11 Hours**

Data abstraction: Basic data structures - Implementation - Classes and objects - Object Oriented Programming
Software Engineering: Lifecycle-Methodologies-Modularity-Quality Assurance-Documentation-Software Ownership and Liability

Current and Future trends in IT **05 Hours**

E-Commerce- EDI-Wireless Application Protocol-Smart Card- IPTV-Blogging-RFID-Brain Computer Interface

TOTAL: 45 HOURS

REFERENCES

1. Introduction to Information Technology, Pearson Education, ITL Education solutions Ltd., 2012
2. Glenn Brookshear J., Computer Science: An Overview, 11th edition, Pearson Education, 2012.
3. Rajaraman V., Introduction to Information Technology, 2nd edition, PHI Learning Private Limited, 2013.

COURSE OUTCOMES

- Outline various functional components of computer system.
- Summarize the functions of operating systems
- Define different types of network topologies and protocols.
- Explain the various internet tools and terminology.
- Explain the basic concept of data abstraction, database, software engineering.

U14CST201/ DIGITAL SYSTEMS AND DESIGN	L	T	P	C
(For Computer Science)	3	1	0	4

OBJECTIVES

- To provide students in-depth theoretical base of the Digital Electronics.
- To provide the fundamental designing concepts of different types of Logic Gates, Minimization techniques etc.
- To familiarize the students regarding designing of different types of the Digital circuits.
- To provide the computational details for Digital Circuits. To introduce the basic concept of Hardware Components.

NUMBER SYSTEM AND BASIC LOGIC **10 Hours**

Number systems - Binary, Octal, Hexadecimal, Number base conversions, Binary codes: Weighted codes - BCD - 8421-2421, Non Weighted codes - Gray code - Excess 3 code Binary arithmetic, 1's complements, 2's complements, and Code conversions. Study of logic gates- Boolean algebra, Boolean postulates and laws –De-Morgan's Theorem- Principle of Duality – Minterm- Maxterm - Canonical forms - Conversion between canonical forms, Karnaugh map Minimization – Don't care conditions, Tabulation method.

COMBINATIONAL CIRCUITS **9 Hours**

Problem formulation and design of combinational circuits, adder, subtractor, Serial adder/ Subtractor - Parallel adder/ Subtractor - Carry look ahead adder - BCD adder - Magnitude Comparator, parity checker, Encoder , decoder, Multiplexer/ Demultiplexer , code converters, Function realization using gates and multiplexers.

SEQUENTIAL CIRCUIT **8 Hours**

Flip flops SR, JK, T, D and Master slave – Characteristic table and equation – Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – Register – shift registers - Universal shift register. Classification of sequential circuits - Moore and Mealy.

DESIGN OF SEQUENTIAL CIRCUITS **10 Hours**

Design of synchronous sequential circuits: state diagram- State table –State minimization – State assignment. Counters: Synchronous Binary counters – Modulo-n counter- Decade - BCD counters, Asynchronous counter, Ring counters. Hazards: Static – Dynamic.

DIGITAL LOGIC FAMILIES AND PLD **8 Hours**

Memories – ROM, PROM, EEPROM, RAM – Programmable Logic Devices: Programmable Logic Array (PLA)- Programmable Array Logic (PAL) - Implementation of combinational logic using PROM, PLA and PAL. Introduction to FPGA. Digital logic families: TTL, ECL, CMOS.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Morris Mano M. and Michael D. Ciletti, Digital Design, 4th edition, Pearson Education (P) Ltd., New Delhi, 2008.
2. John .M Yarbrough, Digital Logic Applications and Design, Thomson- Vikas Publishing House, New Delhi, 2002.
3. Salivahanan S. and Arivazhagan A., Digital Circuits and Design, 3rd edition, Vikas Publishing House (P) Ltd., New Delhi, 2009.
4. Charles H. Roth., Fundamentals of Logic Design, 6th edition, Thomson Publication Company, 2009.
5. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 6th edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007.
6. Jain, R.P. "Modern Digital Electronics", Third Edition., Tata McGraw–Hill publishing company limited, New Delhi, 2003.
7. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2003
8. Donald D. Givone, Digital Principles and Design, Tata Mc-Graw Hill Publishing company Ltd., New Delhi, 2010.

COURSE OUTCOMES

- Translate numerical values in various number systems and perform number conversions between number systems.
- Demonstrate the knowledge of logic gates, Boolean algebra and apply optimal minimization techniques to simplify the Boolean function.
- Analyze and design combinational and sequential circuits.
- Apply the knowledge to solve the real time problems related to digital circuits.
- Compare various programmable devices and digital logic families.

U14EEP212/ ELECTRICAL AND ELECTRONIC CIRCUITS LABORATORY	L	T	P	C
(For Computer Science)	0	0	3	1

OBJECTIVES

- To study the characteristics of resonant circuits
- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Laws
2. Series & Parallel Resonance
3. Power Measurement in series RLC circuit.
4. Half wave and full wave rectifier
5. Zener diode Regulator
6. Common Emitter Transistor characteristics
7. JFET characteristics
8. Wein Bridge oscillator
9. Comparator, summing Amplifier using Op-Amp
10. Integrator and Differentiator using Op-Amp

TOTAL: 45 HOURS

COURSE OUTCOMES

- ➢ Understand and verify the breadboard connections.
- ➢ Check the working condition of a cathode ray oscilloscope.
- ➢ Understand the basic laws of electric circuits.
- ➢ Understand the working of various electronic devices.
- ➢ Understand the performance of an amplifier to carryout different operations.

U14CS*P*201 / COMPUTER HARDWARE LABORATORY	L	T	P	C
(For Computer Science)	**0**	**0**	**3**	**1**

OBJECTIVES

- Acquire in-depth practical knowledge of computer hardware.
- Understanding the connection of networks.
- Develop skills related to the troubleshooting PC.

<u>LIST OF EXERCISES</u>

1. Study the components through assembling and disassembling of PC.
2. Study of different types of network topologies and cables along with crimping.
3. Study of network devices.
4. Installation and configuration of Windows and Linux operating systems.
5. Troubleshooting frequently occurring problems
6. Application software installation.
7. IP configuration and connecting a small LAN including file sharing.
8. Process Handling through task manager
9. Device driver installation.
10. Hands on learning of the Unix /Linux commands
    .

TOTAL: 45 HOURS

COURSE OUTCOMES

- ➢ Explain the various computer hardware components and their functionality.
- ➢ Illustrate the assembling process of a computer system.
- ➢ Explain the local area network and file sharing methods.
- ➢ Perform the installation of Windows and Linux operating system.
- ➢ Summarize the basic Unix /Linux commands.

U14CS*P*202 / DIGITAL SYSTEMS AND DESIGN LABORATORY	L	T	P	C
(For Computer Science)	0	0	3	1

OBJECTIVES

- To provide students in-depth practical base of the Digital Electronics.
- To familiarize the students regarding designing of different types of the Digital circuits.
- To provide the computational details for Digital Circuits.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters, etc.
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices
4. Design and implementation of parity generator / checker using basic gates and MSI devices
5. Design and implementation of magnitude comparator
6. Design and implementation of application using multiplexers
7. Design and implementation of shift registers
8. Design and implementation of synchronous and asynchronous counters
9. Simulation study of any combinational and sequential circuit using VHDL.

COURSE OUTCOMES

On successful completion of this course, the student should be able to

- Construct truth table for specific digital logic functionality.
- Illustrate digital logic function using optimal minimization techniques.
- Construct and troubleshoot the digital circuits.
- Solve the problems related to digital circuits.
- Experiment with digital circuits using VHDL.

TOTAL: 45 HOURS

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY 4 Hours

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY 2 Hours

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE 2 Hours

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S 4 Hours

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT 4 Hours

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim - kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E - ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER - II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14EC*T*201	Circuit Theory	3	1	0	4
U14EC*T*202	Electron Devices	3	0	0	3
	PRACTICAL				
U14PH*P*201	Physics Laboratory	0	0	3	1
U14EC*P*201	Electric Circuits and Simulation Laboratory	0	0	3	1
U14EC*P*202	Electronic Devices Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDITS – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42^{nd} Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4. Singapore, 10^{th} Edition, 2010.
5. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PHT203 / MATERIALS SCIENCE	L	T	P	C
(Common to ECE, EIE, CSE & IT)	3	0	0	3

OBJECTIVES

At end of the course students would be exposed to

- Conducting, super conducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducters: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory .

Dielectric Materials: Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

OPTICAL MATERIALS **9 Hours**

Optical properties of semiconductors – Excitons- Traps – colour centre – Types of colour centres – luminescence – fluorescence and phosphorescence - liquid crystal display – Dynamics scattering display – Twisted nematic crystal display – Non- linear materials – second harmonic generation – optical mixing – optical phase conjugation.

TOTAL: 45 HOURS

REFERENCES

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003
2. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
3. Palanisamy P.K., Materials Science, 2nd edition, Scitech Pub. India, (P) Ltd., Chennai, 2003.
4. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003 (Units: 1,2).
5. Rajendran V., Marikaniv A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd., 2004 (Units: 3,4,5).

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications

U14CH*T*203/ CHEMISTRY FOR CIRCUIT ENGINEERING	L	T	P	C
(Common For ECE, EEE, EIE, IT)	**3**	**0**	**0**	**3**

OBJECTIVES

To impart a sound knowledge on basics of

- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

Formation of polymers – Types of polymers - chain growth and step growth polymerization – Mechanisms - copolymerization - Thermoplastics and thermosets - Micro structures in polymers – polymer length - molecular weight - amorphous and crystalline - thermal transitions in plastics.

APPLIED CONDUCTING POLYMERS 9 Hours

Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELCTRONICS MATERIALS 9Hours

Organo-electronic materials – classification – Production of substrates for organic electronics - Reel-to-reel Vacuum metallization - Organic vapor phase deposition – production of TFTs, OLED, organic photovoltaics - Micro and nanofabrication techniques – Solution based printing.

ORGANIC ELECTRONIC MATERIALS 9 Hours

Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

Pentacene transistors – performance - Engineered pentacenes – Reversible functionalization – end - substituted derivatives - perifunctionalized pentacenes – Heteropentacenes - Semiconductors based on polythiophene and Indolo[3,2-*b*]carbazole – polydialkylterthiophenes – polydialkylquaterthiophenes - polythiophene nanoparticles - indocarbazole designs.

TOTAL: 45 HOURS

REFERENCES

1. Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, Functional Monomers and Polymers, CRC Press, New York.
2. Kaiser A.B., Electronic properties of conjugated polymers, Basics models and applications, Springer verlag, Berlin.
3. Chilton J.A. and Goosey M.T., Special polymers for electronics and optoelectronics, Kluwer Academic Pub., London.
4. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley – VCH, Weinheim
5. Hand book of Conducting Polymers, e-book
6. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, Polymer Science, New Age Int. Pvt. Ltd., New Delhi

COURSE OUTCOMES

- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors

U14ECT201 / CIRCUIT THEORY	L	T	P	C
(Common For ECE, EIE)	3	1	0	4

OBJECTIVES

- Recognize and apply basic electrical units and terminology
- Identify the circuit elements and their corresponding schematic symbols - voltage and current sources (ac and dc), resistors, transformers, capacitors, inductors
- State and apply the laws, rules and theorems to analyze electrical circuit
- Analyze steady state and transient response of source free / driven RL and RC circuits.
- Design and analyze series and parallel Resonance circuits.

DC CIRCUITS ANALYSIS **9 Hours**

Basic Definitions: Charge, Current, Voltage and Power, Circuit elements: Resistors, Inductors, capacitors, Voltage and Current Sources - Ohm's Law, Kirchhoff's Current Law, Kirchhoff's Voltage Law, Circuit elements (R, L, C, Voltage and Current Sources) in Series and Parallel, Voltage and Current Division, Source Transformation, Delta-Star and Star-Delta transformation, Mesh Analysis , super mesh ,Nodal analysis, Super node.

NETWORK THEOREMS **9 Hours**

Superposition Theorem, Thevenin's Theorem and Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Verification of Theorems, Introduction to PSPICE.

SINUSOIDAL STEADY STATE ANALYSIS **9 Hours**

Sinusoids, Phasors, Phasor representation of R, L and C, Phasor Diagrams, Impedance, Admittance, Susceptance, Conductance and Reactance.

AC Circuit Power Analysis-Instantaneous Power, Average Power, RMS Power, Apparent Power and Power Factor, Complex Power, Mesh Analysis & Nodal Analysis, Verification of Maximum Power Transfer theorem

FIRST ORDER AND SECOND ORDER CIRCUITS **9 Hours**

Basic RL and RC Circuits: The Source-Free RL Circuit, the Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits- Source free series and parallel RLC circuits

RESONANCE AND COUPLED CIRCUITS **9 Hours**

Frequency Response of Parallel and Series Resonance circuits-determination of Resonant Frequency, Q – Factor and Bandwidth.

Magnetically Coupled Circuits - Self Inductance, Mutual Inductance, Coefficient of Coupling, Energy in a coupled circuit, Linear Transformer, Ideal Transformer, Duality.

L:45 Hr, T:15 Hr TOTAL: 60 HOURS

REFERENCES

1. Charles K. Alexander and Mathew N.O. Sadiku, Fundamentals of Electric Circuits, 3rd edition, McGraw-Hill, 2008.
2. David E. Johnson, Johny R. Johnson and John L. Hilburn, Electric Circuit Analysis, 2nd edition, Prentice-Hall Int.
3. Murthy K.V.V., Kamath M.S., Basic Circuit Analysis, Jaico Publishing House, 1999.
4. Norman Balaba nian, Electric Circuits, Int. Edition, McGraw-Hill, 1994.
5. Decarlo R.A. and Lin P.M., Linear circuit analysis - The time domain, Phasor and Laplace transform approach, Oxford press, 2nd edition, 2003.
6. William H. Hayt, Jr Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 7th edition, Tata MC GrawHill, 2010.
7. Joseph Edministor and Nahvi (Mohmood), Theory & Problems of Electric Circuits, 5th edition, MC Graw Hill, 2011.

COURSE OUTCOMES

- Able to model passive elements & sources
- Apply circuit theory concepts to compute voltage, current & resistance in DC&AC circuits.
- Use SPICE as a simulation tool to analyze electric circuits.
- Estimate the transient response of simple RL, RC & RLC circuits.
- Predict the frequency response of resonance circuits.

U14ECT202 / ELECTRON DEVICES	L	T	P	C
(For Electronics and Communication Engineering)	3	0	0	3

OBJECTIVES

- Describe the basic concepts of Electron Ballistics
- Illustrate the formation of a p-n junction diode (built-in potential, electric field, charge transport).
- Explain the construction, operation and characteristics of BJT, JFET and MOSFET
- Appraise the functioning of special semiconductor devices: Tunnel diode, SCR, DIAC, TRIAC, UJT, optoelectronic devices.
- Discuss the manufacturing methods for the production of Integrated Circuits.

ELECTRON BALLISTICS **9 Hours**

Force on charge particles in electric field – Motion of charge in uniform and time varying electric fields – Force in a magnetic field – Current Density – Motion in a Magnetic Field – Electrostatic deflection in a cathode ray tube – Magnetic deflection in a cathode ray tube – Deflection sensitivity- Magnetic Focusing –Parallel Electric and Magnetic Fields - Perpendicular Electric and Magnetic Fields – Cyclotron

SEMICONDUCTOR DIODES **9 Hours**

Law of electrical neutrality – Mobility, drift current – Diffusion current – Continuity equation. Band structure of PN Junction – Current Components in a PN Diode –Diode current equation – Temperature dependence of diode characteristics - Calculation of transition and diffusion capacitance – Switching characteristics of diode- Applications - Zener diode – Break down Mechanisms – Zener diode as voltage regulator- Varactor diode – Schottky diode

BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS **9 Hours**

Transistor types – Current components – Ebers – Moll model – Transistor Configurations – Characteristics - Transistor switching times – Transistor as an amplifier. Operation and characteristics of JFET- Generalized FET Amplifier – FET as a voltage variable resistor - MOSFET - Principle of operation - Depletion and Enhancement MOSFET - Output and Transfer Characteristics

SPECIAL SEMICONDUCTOR DEVICES **9 Hours**

Tunnel diode, Operation and Characteristics - SCR ,TRIAC, DIAC - Applications. UJT - Operation - Characteristics – Equivalent Circuit and Applications – Opto electronic devices- LED - Photo diode –Photo transistor

FABRICATION OF SEMICONDUCTOR DEVICES **9 Hours**

Basic monolithic integrated Circuits - Epitaxial growth - masking and etching - Diffusion of impurities- Transistors for monolithic circuits - Monolithic Diodes – Integrated Resistors - Integrated Capacitors & Inductors – Integrated Field Effect Transistors. Definition of LSI, MSI, VLSI circuits

TOTAL: 45 HOURS

REFERENCES

1. David A. Bell, Electronic Devices and Circuits, 4^{th} edition Prentice Hall of India, 2006.
2. Robert L. Boylested and Louis Nashelsky, Electronic Devices and Circuits Theory, 10^{th} edition, Prentice Hall India, 2009.
3. Theodore F. Bogart Jr, Jeffrey S. Beasley and Guillermo Rico, Electronic Devices and Circuits, 6^{th} edition, Pearson Education, 2004.
4. Jacob Millman, Christos C. Halkias and Chetan D. Parikh, Integrated Electronics, 2^{nd} edition, Tata McGraw–Hill, 2009.
5. Jacob Millman, Christos C. Halkias and Sathyabrata Jit, Electronic Devices and Circuits, 3^{rd} edition, Tata McGraw–Hill, 2011.

COURSE OUTCOMES

- Recognize the concepts of Electron ballistics
- Understand the principles of Semiconductor Physics
- Illustrate the characteristics of diodes, BJT, FET, MOSFET and their applications.
- Develop skills to implement simple projects using the basic devices

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY	L	T	P	C
(Common to all branches of Engineering and Technology)	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

5. Determination of solar cell parameters
6. Hall effect
7. Four probe apparatus
8. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations

U14EC*P*201/ ELECTRIC CIRCUITS & SIMULATION LABORATORY	L	T	P	C
(For Electronics and Communication Engineering)	0	0	3	1

OBJECTIVES

- Assemble simple electric circuits with passive elements and sources.
- Verify laws and theorems in electric circuits
- Design and analyze series and parallel resonant circuits
- Use simulation tools to analyze electric circuits.

LIST OF EXPERIMENTS

1. Measurement of current and voltage in series and parallel circuits.
2. Verification of Kirchhoff's Laws.
3. Verification of Thevenin's Theorem
4. Verification of Reciprocity Theorem
5. Verification of Super position Theorem
6. Verification of Maximum Power Transfer Theorem
7. Frequency Response of Series and Parallel resonance circuits

PSPICE SIMULATION

8. Verification of Theorems
9. Analysis of Transient Response of RL & RC circuits
10. Analysis of Series and parallel resonance circuits

TOTAL: 45 HOURS

COURSE OUTCOMES

- Practice proper use of measuring instruments.
- Relate physical observations and measurements involving electrical circuits to theoretical principles.
- Experiment series and parallel resonance circuits.
- Able to use simulation tools to analyze electric circuits.

U14EC*P*202/ ELECTRONIC DEVICES LABORATORY	L	T	P	C
(For Electronics and Communication Engineering)	**0**	**0**	**3**	**1**

OBJECTIVES

- Sketch the characteristics of the semiconductor devices: Diode, Zener diode, Transistor, FET, MOSFET, UJT, SCR, Photo diode & Photo transistor.
- Demonstrate the application circuits: rectifier, voltage regulator and BJT amplifier.

LIST OF EXPERIMENTS

1. PN Diode VI –Characteristics
2. Half Wave and Full wave rectifier
3. Zener Diode characteristics and Voltage regulator
4. Transistor (CE) characteristics and h parameter determination
5. JFET characteristics
6. MOSFET characteristics
7. UJT characteristics
8. SCR characteristics
9. TRIAC and DIAC characteristics
10. Photo Diode and Photo Transistor characteristics
11. BJT as an amplifier and switch

TOTAL: 45 HOURS

COURSE OUTCOMES

- Analyze the characteristics and behavior of devices like diode, zener diode, BJT, FET, MOSFET, UJT, SCR and optoelectronic devices
- Verify the working of diodes, transistors and their applications
- Build a common emitter/base/collector amplifier and measure h-parameters.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	**1**	**0**	**1**	**1**

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities-Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA **4 Hours**

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11^{th} edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39^{th} edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E - ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*205	Applied Physics	3	0	0	3
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14EE*T*201	Circuit Theory	3	1	0	4
U14ME*T*204	Thermal Engineering and Fluid Mechanics	3	1	0	4
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14EEP201	Basics of Electric Circuits lab	0	0	3	1
U14ME*P*202	Thermal Engineering and Fluid Mechanics Lab	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 33 HOURS **TOTAL CREDIT – 25**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42^{nd} Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4. Singapore, 10^{th} Edition, 2010.
5. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PHT205 / **APPLIED PHYSICS**	**L**	**T**	**P**	**C**
(For Electrical and Electronics Engineering)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in

- Design of acoustically good buildings
- Properties and applications of conducting materials, Superconducting materials, magnetic and dielectric materials.
- Preparation, properties and applications of Metallic glasses, Shape memory alloys and Nano materials.
- Plasma, types and its applications

ACOUSTICS **9 Hours**

Classification of sound – characteristics of musical sound –loudness –Weber-Fechner law – decibel, phon – Reverberation – reverberation time – derivation of Sabines formula for reverberation time (rate of growth and rate of decay) –Absorption coefficient and its determination – factors affecting acoustics of buildings –optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise and their remedies –sound absorping materials –noise pollution – noise contrl in machines.

CONDUCTING AND SUPERCONDUCTING MATERIALS **9 Hours**

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING & OPTICAL MATERIALS **9 Hours**

Origin of band gap in solids (Qualitative treatment only) - carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration –

Optical properties of semiconductors – Excitons- Traps – colour centre – Types of colour centres – luminescence – fluorescence and phosphorescence.

MAGNETIC & DIELECTRIC MATERIALS **9 Hours**

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy,magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

PLASMA AND NANOTECHNOLOGY **9 Hours**

Plasma Technology : properties of plasma- types of plasma- thermal and non thermal plasma-Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field.

Nano Materials - synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

TOTAL: 45 HOURS

REFERENCES

1. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
2. Palanisamy P.K., Materials Science, 2nd edition, Scitech Pub. India (P) Ltd.
3. Pillai S.O., Solid State Physics, 5th edition, New Age Int. Publication, New Delhi, 2003.
4. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2004
5. Goldston R.J., Rutherford P.H., Introduction of Plasma Physics-I, CRC publication, New York, America, 2000
6. Rajendran V. and Marikani A., Materials Science, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Describe the impact of acoustic engineering solutions in a constructional environmental, and societal context.
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the concepts of nanomaterials and modern materials for explaining surface properties like adhesion etc. in engineering practice.

U14CH*T*203/ CHEMISTRY FOR CIRCUIT ENGINEERING	L	T	P	C
(Common For ECE, EEE, EIE, IT)	**3**	**0**	**0**	**3**

OBJECTIVES

To impart a sound knowledge on basics of

- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

Formation of polymers – Types of polymers - chain growth and step growth polymerization – Mechanisms - copolymerization - Thermoplastics and thermosets - Micro structures in polymers – polymer length - molecular weight - amorphous and crystalline - thermal transitions in plastics.

APPLIED CONDUCTING POLYMERS 9 Hours

Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELCTRONICS MATERIALS 9Hours

Organo-electronic materials – classification – Production of substrates for organic electronics - Reel-to-reel Vacuum metallization - Organic vapor phase deposition – production of TFTs, OLED, organic photovoltaics - Micro and nanofabrication techniques – Solution based printing.

ORGANIC ELECTRONIC MATERIALS 9 Hours

Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

Pentacene transistors – performance - Engineered pentacenes – Reversible functionalization – end - substituted derivatives - perifunctionalized pentacenes – Heteropentacenes - Semiconductors based on polythiophene and Indolo[3,2-*b*]carbazole – polydialkylterthiophenes – polydialkylquaterthiophenes - polythiophene nanoparticles - indocarbazole designs.

TOTAL: 45 HOURS

REFERENCES

1. Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, Functional Monomers and Polymers, CRC Press, New York.
2. Kaiser A.B., Electronic properties of conjugated polymers, Basics models and applications, Springer verlag, Berlin.
3. Chilton J.A. and Goosey M.T., Special polymers for electronics and optoelectronics, Kluwer Academic Pub., London.
4. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley – VCH, Weinheim
5. Hand book of Conducting Polymers, e-book
6. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, Polymer Science, New Age Int. Pvt. Ltd., New Delhi

COURSE OUTCOMES

- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors

U14EE*T*201 / CIRCUIT THEORY	L	T	P	C
(For Electrical and Electronics Engineering)	3	1	0	4

OBJECTIVES

- To understand the concept of electrical circuits, characteristics of circuit elements and power sources.
- To analyse A.C. circuits, the concept of active, reactive and apparent powers, power factor and resonance in series and parallel circuits.
- To solve electrical network problems using mesh and nodal analysis and by applying network theorems.
- To know the basic concepts of magnetic coupled circuits
- To know the fundamental relationships involved with three phase circuits and power measurement.

BASIC CIRCUIT CONCEPTS **9 Hours**

Introduction to Electrical Circuits: voltage, current, power and energy. Circuit elements : R,L,C parameters – Energy sources – Kirchhoff's laws –Series and parallel DC circuits-voltage division and current division-power in dc series and parallel circuits-network reduction techniques – Source transformation- star-to-delta and delta-to-star transformation.

AC CIRCUIT CONCEPTS **9 Hours**

The sine wave- Angular relation of a sine wave-The sine wave equation-Voltage and current Values of sine wave- Phase relation in Pure R, L and C . Complex impedance :impedance diagram– Phasor diagram- Analysis of series, parallel and Compound circuits. Power and power factor: Instantaneous Power - Average Power- Apparent Power and Power Factor-Reactive Power- Power Triangle. Series resonance and Parallel resonance – bandwidth and Q factor.

CIRCUIT ANALYSIS & NETWORK THEOREMS **9 Hours**

Nodal analysis and Mesh analysis for D.C and A.C circuits, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, maximum power transfer theorem, Duality in networks-problems.

MAGNETIC COUPLED CIRCUITS **9 Hours**

Self and mutual inductance-coefficient of coupling-dot convention-analysis of simple coupled circuits-ideal transformer-analysis of series and parallel connection of coupled coils-tuned circuits-analysis of magnetic circuits-comparisons of magnetic and electric circuits-magnetic leakage and fringing-parallel magnetic circuit.

THREE PHASE CIRCUITS **9 Hours**

Phase sequence-line and phase quantities-Three phase star and delta connections -analysis of three phase circuits with star and delta connected balanced and unbalanced loads- power measurement in three phase circuits using two wattmeter method-power factor of an unbalanced system.

L: 45 Hr T: 15 Hr TOTAL: 60 HOURS

REFERENCES

1. William H. Hayt Jr, Jack E. Kemmberly, and Steven M. Durbin, Engineering circuit analysis, Tata McGraw-Hill, New Delhi, 2002.
2. Joseph A. Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Series, Tata, McGraw-Hill, New Delhi, 2004.
3. Arumugam M. and Premkumar N., Electric Circuit Theory, Kanna Publishers, New Delhi, 1991.
4. Gupta B.R, Fundamentals of ElectruCircuits, S. Chand & Company (P) Ltd., New Delhi. 2002.
5. Paranjothi S.R., Electric Circuit Analysis, New Age International (P) Ltd., New Delhi, 2000.
6. Sudhakar A. and Shyammohan S.P., Circuits and Networks: Analysis and Synthesis, Tata McGraw-Hill, New Delhi, 2004.

COURSE OUTCOMES

- Determine the current and voltage magnitudes by applying laws. Students can also reduce the complex circuits to simple forms using reduction techniques and source transformations. Students will be able to draw the phasor diagrams and can find the design parameters (Q factor and bandwidth) for series and parallel resonance circuits.
- Reduce the complex circuits to simple circuits and apply mesh and nodal analysis to compute the current and voltage magnitudes in different branches of the given circuit.
- Understand the concepts of magnetic circuits and can compute the effective inductance with respect to different parameters like number of turns, flux, area, direction of winding current and flux density. Students understand the 3 phase concepts and its types applicable for both balanced and unbalanced load.

U14MET204/ THERMAL ENGINEERING AND FLUID MECHANICS	L	T	P	C
(For Electrical and Electronics Engineering)	3	1	0	4

OBJECTIVES

- To introduce principles of power generation utilizing various sources
- To introduce the basic concepts in various thermal applications like IC engines, gas, steam turbines and compressors.
- To gain knowledge regarding the fundamentals of fluid flow and their Applications.

POWER PLANT ENGINEERING 9 Hours

Introduction, Classification of Power Plants – Working principles of thermal (coal, gas and diesel), Hydro-electric and Nuclear Power plants – Merits and Demerits – Non-conventional power generation methods- Solar and wind power – Boilers - construction and working principles of Cochran, Babcock and Wilcox boilers

PRIME MOVERS 9 Hours

Steam turbines-Impulse (Delaval) and reaction turbines – Hydraulic prime movers- Pelton and Kaplan turbines- Internal combustion engines as automobile power plant – Working principles of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

REFRIGERATION AND AIR CONDITIONING 9 Hours

Positive displacement compressors – Reciprocating compressors- Rotary positive displacement compressors - Construction and working principles of centrifugal and axial flow compressors. Refrigeration –Vapour compression and vapour absorption refrigeration – Air conditioning- Terminology- Classification as to season of the year - window room air conditioning- thermoelectric cooling-applications.

FLUID PROPERTIES AND FLOW CHARACTERISTICS 9 Hours

Fluid properties – Viscosity – Surface Tension – Capillarity – Fluid Pressure and Pressure Head – Types of Fluid Flow – Flow Lines – Continuity Equation Euler’s equations – Bernoulli’s Equation and Applications – Viscous flow and turbulent flow

FLUID FLOW APPLICATIONS 9 Hours

Energy losses due to fluid flow – Flow through Circular Pipes - Flow through pipes in series and parallel – Major and Minor Losses – Hydraulic Grade Line and Total Energy Line – Working principles of centrifugal pumps, reciprocating pumps (single acting and double acting).

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Domkundwar S., Kotandaraman C.P. and Domkundwar A.V., Thermal Engineering, Dhanpat Rai & Co, 2002.
2. Modi P.N. and Seth S.M., Hydraulic & Fluid Mechanics including Hydraulic Machines, Standard Book, 2006.
3. Venugopal K. and Prabhuraja V., Basic Mechanical Engineeering, Anuradha Publishers, 2005
4. Bansal R.K., Fluid Mechanics & Hydraulic Machines, Lakshmi Publications (P) Ltd., 2006

COURSE OUTCOMES

- Demonstrate understanding of basic concepts of thermodynamics, power plants and prime movers.
- Understand the working of air conditioning systems.
- Solve problems in fluid properties and flow dynamics.

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.

Apply physical theories in real life situations by also taking into account its limitations

U14ME*P*202/ THERMAL ENGINEERING & FLUID MECHANICS LABORATORY	L	T	P	C
(For Electrical and Electronics Engineering)	0	0	3	1

OBJECTIVES

- Expected to gain knowledge regarding the working of IC engines and air compressors.
- Expected to gain knowledge regarding the fundamentals of fluid flow and their applications to flow through pipes and hydraulic machines.

LIST OF EXPERIMENTS

THERMODYNAMICS LAB

1. Study of a Petrol Engine
2. Study of a Diesel Engine
3. Study of a IC Engine
4. Performance evaluation of four stroke diesel engine using rope brake dynamometer
5. Test on reciprocating air compressor

FLUID MECHANICS LABORATORY

1. Flow measurements using venturi meter
2. Test to estimate frictional losses in pipe flow.
3. Test on positive displacement pump for obtaining its characteristics curves and design flow parameters.
4. Test on centrifugal pump for obtaining its characteristics curves and design flow parameters.
5. Test on jet pump for obtaining its characteristics curves and design flow parameters.
6. Test on reaction turbine for obtaining the characteristics curve and to design values of specific speed, discharge, output and efficiency.
7. Test on impulse turbine to obtain its characteristics curves and hydraulic design values.

TOTAL: 45 HOURS

COURSE OUTCOMES

- Conduct tests on engine performance.
- Study petrol and diesel engine working principles.
- Examine the pump characteristics and conduct test on turbines.

U14EE*P*201/ BASICS OF ELECTRIC CIRCUITS LABORATORY	L	T	P	C
(For Electrical and Electronics Engineering)	0	0	3	1

OBJECTIVES

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.

LIST OF EXPERIMENTS

1. Verifications of Ohm's Laws & Kirchhoff's Laws.
2. Verifications of Superposition theorem.
3. Verifications of Thevenin's theorem.
4. Verifications of Norton' s theorem.
5. Verifications of Reciprocity theorem.
6. Verifications of Maximum power transfer theorem.
7. Verifications of Mesh analysis.
8. Verifications of Nodal analysis.
9. Phasor relationships in RL & RC circuits.
10. Frequency response RL & RC Circuits
11. Frequency response of series resonance circuit.
12. Frequency response of parallel resonance circuit.

TOTAL: 45 HOURS

COURSE OUTCOMES

- Reduce the given complex circuit to simple circuit by applying theorems and can verify the theoretical and practical outputs
- Find the impedance value of the given circuit at which the maximum power is transferred and also confirms with the practical results
- Find the magnitudes of voltages and currents in the given circuit and verifies experimentally using mesh and nodal analysis
- Demonstrate frequency response, Phasor relationships for the given RL, RC circuits and verify experimentally.
- Design a circuit to accept or reject a particular frequency using resonance principle.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	**1**	**0**	**1**	**1**

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.

Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA **4 Hours**

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14EC*T*201	Circuit Theory	3	1	0	4
U14EI*T*201	Electronic Devices	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14EI*P*201	Circuits and Devices Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MAT201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1 Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).

2 Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)

3 Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,

4 Singapore, 10th Edition, 2010.

5 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.

6 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.

7 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.

8 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PH*T*203 / MATERIALS SCIENCE	L	T	P	C
(Common to ECE, EIE, CSE & IT)	**3**	**0**	**0**	**3**

OBJECTIVES

At end of the course students would be exposed to

- Conducting, super conducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducters: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory .

Dielectric Materials: Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes –

fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

OPTICAL MATERIALS **9 Hours**

Optical properties of semiconductors – Excitons- Traps – colour centre – Types of colour centres – luminescence – fluorescence and phosphorescence - liquid crystal display – Dynamics scattering display – Twisted nematic crystal display – Non- linear materials – second harmonic generation – optical mixing – optical phase conjugation.

TOTAL: 45 HOURS

REFERENCES

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003
2. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
3. Palanisamy P.K., Materials Science, 2nd edition, Scitech Pub. India, (P) Ltd., Chennai, 2003.
4. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003 (Units: 1,2).
5. Rajendran V., Marikaniv A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd., 2004 (Units: 3,4,5).

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications

U14CH*T*203/ CHEMISTRY FOR CIRCUIT ENGINEERING	L	T	P	C
(Common For ECE, EEE, EIE, IT)	**3**	**0**	**0**	**3**

OBJECTIVES

To impart a sound knowledge on basics of

- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

Formation of polymers – Types of polymers - chain growth and step growth polymerization – Mechanisms - copolymerization - Thermoplastics and thermosets - Micro structures in polymers – polymer length - molecular weight - amorphous and crystalline - thermal transitions in plastics.

APPLIED CONDUCTING POLYMERS 9 Hours

Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELCTRONICS MATERIALS 9Hours

Organo-electronic materials – classification – Production of substrates for organic electronics - Reel-to-reel Vacuum metallization - Organic vapor phase deposition – production of TFTs, OLED, organic photovoltaics - Micro and nanofabrication techniques – Solution based printing.

ORGANIC ELECTRONIC MATERIALS 9 Hours

Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

Pentacene transistors – performance - Engineered pentacenes – Reversible functionalization – end - substituted derivatives - perifunctionalized pentacenes – Heteropentacenes - Semiconductors based on polythiophene and Indolo[3,2-*b*]carbazole – polydialkylterthiophenes – polydialkylquaterthiophenes - polythiophene nanoparticles - indocarbazole designs.

TOTAL: 45 HOURS

REFERENCES

1. Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, Functional Monomers and Polymers, CRC Press, New York.
2. Kaiser A.B., Electronic properties of conjugated polymers, Basics models and applications, Springer verlag, Berlin.
3. Chilton J.A. and Goosey M.T., Special polymers for electronics and optoelectronics, Kluwer Academic Pub., London.
4. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley – VCH, Weinheim
5. Hand book of Conducting Polymers, e-book
6. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, Polymer Science, New Age Int. Pvt. Ltd., New Delhi

COURSE OUTCOMES

- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors

U14EC*T*201 / CIRCUIT THEORY	L	T	P	C
(Common For ECE, EIE)	**3**	**1**	**0**	**4**

OBJECTIVES

- Recognize and apply basic electrical units and terminology
- Identify the circuit elements and their corresponding schematic symbols - voltage and current sources (ac and dc), resistors, transformers, capacitors, inductors
- State and apply the laws, rules and theorems to analyze electrical circuit
- Analyze steady state and transient response of source free / driven RL and RC circuits.
- Design and analyze series and parallel Resonance circuits.

DC CIRCUITS ANALYSIS **9 Hours**

Basic Definitions: Charge, Current, Voltage and Power, Circuit elements: Resistors, Inductors, capacitors, Voltage and Current Sources - Ohm's Law, Kirchhoff's Current Law, Kirchhoff's Voltage Law, Circuit elements (R, L, C, Voltage and Current Sources) in Series and Parallel, Voltage and Current Division, Source Transformation, Delta-Star and Star-Delta transformation, Mesh Analysis , super mesh ,Nodal analysis, Super node.

NETWORK THEOREMS **9 Hours**

Superposition Theorem, Thevenin's Theorem and Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Verification of Theorems, Introduction to PSPICE.

SINUSOIDAL STEADY STATE ANALYSIS **9 Hours**

Sinusoids, Phasors, Phasor representation of R, L and C, Phasor Diagrams, Impedance, Admittance, Susceptance, Conductance and Reactance.

AC Circuit Power Analysis-Instantaneous Power, Average Power, RMS Power, Apparent Power and Power Factor, Complex Power, Mesh Analysis & Nodal Analysis, Verification of Maximum Power Transfer theorem

FIRST ORDER AND SECOND ORDER CIRCUITS **9 Hours**

Basic RL and RC Circuits: The Source-Free RL Circuit, the Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits- Source free series and parallel RLC circuits

RESONANCE AND COUPLED CIRCUITS **9 Hours**

Frequency Response of Parallel and Series Resonance circuits-determination of Resonant Frequency, Q – Factor and Bandwidth.

Magnetically Coupled Circuits - Self Inductance, Mutual Inductance, Coefficient of Coupling, Energy in a coupled circuit, Linear Transformer, Ideal Transformer, Duality.

L:45 Hr, T:15 Hr TOTAL: 60 HOURS

REFERENCES

1. Charles K. Alexander and Mathew N.O. Sadiku, Fundamentals of Electric Circuits, 3rd edition, McGraw-Hill, 2008.
2. David E. Johnson, Johny R. Johnson and John L. Hilburn, Electric Circuit Analysis, 2nd edition, Prentice-Hall Int.
3. Murthy K.V.V., Kamath M.S., Basic Circuit Analysis, Jaico Publishing House, 1999.
4. Norman Balaba nian, Electric Circuits, Int. Edition, McGraw-Hill, 1994.
5. Decarlo R.A. and Lin P.M., Linear circuit analysis - The time domain, Phasor and Laplace transform approach, Oxford press, 2nd edition, 2003.
6. William H. Hayt, Jr Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 7th edition, Tata MC GrawHill, 2010.
7. Joseph Edministor and Nahvi (Mohmood), Theory & Problems of Electric Circuits, 5th edition, MC Graw Hill, 2011.

COURSE OUTCOMES

- Able to model passive elements & sources
- Apply circuit theory concepts to compute voltage, current & resistance in DC&AC circuits.
- Use SPICE as a simulation tool to analyze electric circuits.
- Estimate the transient response of simple RL, RC & RLC circuits.
- Predict the frequency response of resonance circuits.

U14EIT201 / ELECTRONIC DEVICES	L	T	P	C
(For Electronics and Instrumentation Engineering)	3	0	0	3

OBJECTIVES

- To describe how current flows through PN junction & relating this phenomena to the characteristics & operation of the diodes, bipolar, FET transistors.
- To expose students to the functions and application of diodes, BJT &FET in electronic circuits.

SEMICONDUCTOR DIODE **9 Hours**

Theory of p-n junction – p-n junction as diode – p-n diode currents – Volt-amp characteristics – Diode resistance – Temperature effect of p-n junction – Transition and diffusion capacitance of p-n diode – Diode switching times.

BI-POLAR TRANSISTOR **9 Hours**

Junction transistor – Transistor construction – Detailed study of currents in transistor – Input and output characteristics of CE, CB and CC configurations – Transistor hybrid model for CE configuration – Analytical expressions for transistor characteristics – Transistor switching times – Voltage rating – Power transistors.

FIELD EFFECT TRANSISTORS **9 Hours**

Junction field effect transistor – Pinch off voltage – JFET volt-ampere characteristics – JFET small signal model – MOSFETS and their characteristics – FET as a variable resistor – Unijunction transistor.

OPTO ELECTRONIC DEVICES **9 Hours**

Photo emissivity and photo electric theory – Theory, construction and characteristics: light emitting diodes, liquid crystal cell, seven segment display, photo conductive cell, photodiode, solar cell, photo transistor, opto couplers and laser diode.

OTHER DEVICES **9 Hours**

Theory, characteristics and application: SCR, TRIAC, PUT, tunnel diode, thermistors, piezo electric devices, zener diode, charge coupled devices, varactor diode and LDR.

TOTAL: 45 HOURS

REFERENCES

1. Jacob Millman, Christos C. Halkias, Electronic Devices and Circuits, Tata McGraw Hill Publishing Ltd., New Delhi, 2003.
2. Salivahanan S. and Suresh Kumar N., Electronic Devices and circuits, Tata McGraw Hill Publishing Ltd., New Delhi, 2003.
3. Godse A.P. and Bakshi U.A., Electronic Devices and Circuits, Technical Pub., 2010.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India (P) Ltd., New Delhi, 2003.

COURSE OUTCOMES

- Describe the working principle and characteristics of various electronic devices like FET, BJT, PN Junction Diode and other Electronics devices.

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.

Apply physical theories in real life situations by also taking into account its limitations

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    a. Addition of two images
    b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14EI*P*201/ CIRCUITS AND DEVICES LABORATORY	L	T	P	C
(For Electronics and Instrumentation Engineering)	**0**	**0**	**3**	**1**

OBJECTIVES

- To experimentally verify the characteristics of P-N diode, BJT, FET, UJT, TRIAC SCR.
- To verify the various theorems like super position, Thevenin, Norton and Maximum power transfer theorem.

LIST OF EXPERIMENTS

1. Characteristics of semiconductor and Zener diode.
2. Characteristics of transistor under CE configuration and Determination of h parameters
3. Characteristics of transistor under CB configuration and Determination of h parameters
4. Characteristics of JFET.
5. Characteristics of UJT.
6. Verification of ohms law, Kirchhoff's voltage and current laws.
7. Verification of Thevenin's and Norton's Theorems.
8. Verification of Superposition and maximum power transfer theorem.
9. Characteristics of SCR.
10. Characteristics of Triac.
11. Characteristics of MOSFET
12. Characteristics of Resonance circuits.

TOTAL: 45 HOURS

COURSE OUTCOMES

- Demonstrate the working of various electronic devices.
- Compute and experimentally verify thevenin's,Norton,Superposition, Maximum power transfer theorems.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	**1**	**0**	**1**	**1**

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA **4 Hours**

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION **10 Hours**

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.Tech - TEXTILE TECHNOLOGY (FASHION TECHNOLOGY)

SEMESTER – II

Code No.	**Course Title**	**L**	**T**	**P**	**C**
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*204	Applied Physics	3	0	0	3
U14CH*T*204	Chemistry for Textiles	3	0	0	3
U14FT*T*201	Fiber Science and Yarn Technology	3	0	0	3
U14FT*T*202	Weaving Technology	3	0	0	3
	PRACTICAL				
U14PH*P*201	Physics Laboratory	0	0	3	1
U14FT*P*201	Textile Production Process Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 31 HOURS **TOTAL CREDIT – 23**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	**2**	**0**	**2**	**3**

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4. Singapore, 10th Edition, 2010.
5. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

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U14PHT204 / APPLIED PHYSICS	L	T	P	C
(Common to Textile Technology and Fashion Technology)	3	0	0	3

OBJECTIVES

At the end of the course the students would be exposed to

- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.
- Application of ultrasonic and nuclear physics in medicine.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin’s theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS **9 Hours**

Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA . Ceramics-Classification of ceramics- Fabrication, Properties and application. Biomaterials-Biomechanisim - Classification of Biomaterials-Processing, Properties and applications.

NANO SCIENCE AND PLASMA TECHNOLOGY **9 Hours**

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

Plasma Technology: properties of plasma- types of plasma- thermal and non thermal plasma-Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field.

TOTAL: 45 HOURS

REFERENCES

1. Gopal S., Materials Science, Inder Pub., Coimbatore, 2007.
2. Pillai S.O., Solid State Physics, 5th edition, New Age International Pub., New Delhi, 2003.
3. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2005
4. Rajendran V. and Marikani A., Materials Science, Tata McGraw Hill Pub. Company Ltd., New Delhi, 2004
5. Goldston R.J. and Rutherford P.H., Introduction of Plasma Physics-I, CRC Pub., New York, America, 2000

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Illustrate the electrical / thermal conductivity of semiconductors and determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the concepts of nanomaterials and modern materials for explaining surface properties like adhesion etc. in engineering practice.
- Identify methods for etching of fabrics

U14CHT204 / CHEMISTRY FOR TEXTILES	L	T	P	C
(Common to Textile Technology and Fashion Technology)	3	0	0	3

OBJECTIVES

- To correlate theoretical principles with application oriented studies
- To embark on the usage of theoretical and modern technological aspects in polymers and dyes to exhibit engineering and technical concepts as required for Textile and Fashion Technology students.

WATER TECHNOLOGY **9 Hours**

Disadvantages of hard water in textile industries – Conditioning methods : external treatment (Ion exchange method), internal treatment (colloidal, phosphate, calgon & carbonate methods) – desalination (reverse osmosis and electro-dialysis) – Common effluent treatment.

POLYMERS **9 Hours**

Introduction – Degree of polymerization – functionality – tacticity - classification based on source, application, thermal properties (thermosetting and thermoplastics) - effect of polymer structure on properties – types of polymerization (addition, condensation, co-polymerization, Ring polymerisation) - mechanism of polymerization (free radical mechanism)

Preparation (mechanism not required) and applications of polythene, polypropylene, polystyrene, polyamides (nylon 6,6), polyesters (PET)

CHEMICAL BONDING **9 Hours**

Ionic, covalent and co-ordinate covalent bonds (overview only) -- hydrogen bonding and its consequences - van der Waal's forces (dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions) - Interaction of enzymes with fibres (basic concepts only). Interaction between fibers and dyes (basic concepts only) - Dyes substrate affinity (dyes for cellulose fibres, silk)

DYES **9 Hours**

Introduction - Classification system of dyes - Chromophore and auxochromes – Important chemical chromophores of dyes classes (azo, anthraquinone, phthalocyanin, Indigoid, polymethine, phthalocyanine, metal complex, Fluorescent) - synthesis of azo dye (Congo red), triaryl methane dye (Malachite green), Anthraquinone dye (Alizarin - 1,2 dihydroxy anthraquinone), Indigoid dye (Indigo), phthalein dyes (Eosin)

ANTHOLOGY OF SPECIALITY CHEMICALS IN TEXTILES 9 Hours

An introduction on chemistry of the following in textiles: Dispersing agents, levelling agents, Retarding agents, Dye fixing agents.

Thermal analysis (DSC): Principle, Instrumentation and application in Textiles

TOTAL: 45 HOURS

REFERENCES

1. Finar I.L, Organic chemistry, Pub. House, UK.
2. Hungar K., Industrial Dyes - Chemistry, properties and applications, Wiley VCH Verlag GmbH & Co., KGaA, Weinheim.
3. Sivaramakrishnan C.N., Anthology of speciality chemicals for textiles, Colour Pub. (P) Ltd., Mumbai, India.
4. Seymour R.B. and Carraher, Polymer chemistry, Plenum Pub. Corporation, New York.
5. Kuriacose J.C. and Rajaram J., Chemistry in Engineering and Technology, Vol. 1 & 2, Tata McGraw-Hill Pub. Co., Ltd., New Delhi.
6. Syed Shabudeen P.S. and Shoba U.S., Chemistry for textiles, Inder Pub., Coimbatore.
7. Amarika Singh, Vairam S. and Suba Ramesh., Chemistry for engineers., Wiley India Ltd., New Delhi
8. Bahl B.S. and Arun Bahl., A Textbook Of Organic Chemistry, S. Chand & Co., New Delhi
9. Hungar K., Industrial Dyes - Chemistry, properties and applications, John Wiley & Sons

COURSE OUTCOMES

- Design a water purifier
- Discuss the mechanism of polymer formation
- Classify dyes and describe its interaction with fibers using bonding.
- Analyse the usage of specialty chemicals in dyes

U14FTT201/ FIBRE SCIENCE AND YARN TECHNOLOGY	L	T	P	C
(For Fashion Technology)	3	0	0	3

OBJECTIVES

- To acquire knowledge on properties of texile fibres and their manufacturing methods
- To impart knowledge on the conventional and modern yarn manufacturing process

TEXTILE FIBRES **9 Hours**

Introduction: Definition of staple fibre, filament, bicomponent fibres. Classification of natural and man-made fibres, essential and desirable properties of fibres.

Production and cultivation of Natural Fibers: Cultivation of cotton, production of silk (sericulture), wool and jute – physical and chemical structure of these fibres.

Production sequence of modified cellulosic fibres: Viscose Rayon, Acetate Rayon, high wet modulus and high tenacity fibres. Physical and chemical properties of the above fibres.

PRODUCTION SEQUENCE AND PHYSICAL AND CHEMICAL PROPERTIES OF SYNTHETIC FIBERS **9 Hours**

Polyester, Nylon and Acrylic. Introduction to spin finishes and texturisation.

Speciality fibres: High temperature and flame retardant fibres, elastomeric fibres, Polylactic Acid (PLA) fibre, nano-fibres, metallic fibres-Gold and Silver coated, super-absorbent fibres for medical and hygiene applications.

SHORT STAPLE SPINNING SYSTEM (COTTON) **9 Hours**

Sequence of process in cotton spinning - Ginning-objectives, types, suitability and principle of working; objectives and principles of working of Blow room, Carding, Drawing, Combing, Simplex and spinning machines -Ring spinning and Ringless-Rotor spinning, Air jet spinning and DREF spinning machines.

LONG STAPLE SPINNING SYSTEM **9 Hours**

Sequence of process in woolen and worsted spinning; objectives and principles of Scouring, Drying, Oiling, Dyeing, Blending, Carding, Gilling and Combing, Roving and Spinning – Siro, Solo and Compact spinning systems.

POST SPINNING **9 Hours**

Objectives and principles of working of Reeling, Assembly winder, Ring doubler and Two for one twister (TFO); Single yarn and ply yarn characteristics and their applications. Sewing threads. Package faults (Cones, Cheese and Hanks) and identification.

TOTAL: 45 HOURS

REFERENCES

1. Morton W.E. and Hearle J.W.S., Physical Properties of Textile Fibres, The Textile Institute, Manchester, U.K., 1993.
2. Mukhopadhyay S.K., Advances in Fibre Science, The Textile Institute, U.K., 1992.
3. Gupta V.B., Textile Fibres: Developments and Innovations, Vol. 2, Progress in Textiles: Science and Technology, Edited by V.K. Kothari, IAFL Pub., 2000.
4. Oxtoby E., Spun Yarn Technology, Butterworth & Co., London, 1991.
5. Chellamani K.P. and Chattopadhyay D., Yarns and Technical Textiles, SITRA Pub., 1st edition, 1999.
6. Corbman B.P., Textiles: Fibre to Fabric, McGraw Hill int. edition,1983.
7. Mishra S.P., Fibre Science and Technology, New Age Int. Pub., 2000
8. Klien W.G., The Technology of Short Staple Spinning, Vol. 1-5, The Textile Institute, Manchester, 1988
9. Mahendra Gowda, R.V., New Spinning Systems, NCUTE Pub., 2nd edition, 2006

COURSE OUTCOMES

- Acquire knowledge on the basic forms of textiles namely fibres, their classification and properties, and on the cultivation/production of natural fibres as well as modified fibres from natural raw materials.
- Outline the production of synthetic fibres, and acquire knowledge on their physical and chemical properties as well as their applications.
- Outline sequentially the processes involved in spinning cotton and worsted yarns, and describe the working of various machines used, from fibre preparation to yarn spinning

U14FTT202 / WEAVING TECHNOLOGY	L	T	P	C
(For Fashion Technology)	3	0	0	3

OBJECTIVES

- Acquire knowledge in weaving preparatory process
- Develop skills in basic principles of working of shuttle and shuttleless loom mechanisms
- Understand the process of weaving and controlling quality

YARN PREPARATION FOR WEAVING **9 Hours**

Process Flow – objectives of winding; principles of cheese and cone winding Machines; concepts in yarn clearing – mechanical, optical and electronic clearers; knotters and splicers; Yarn quality requirements for weaving.

BEAM PREPARATION FOR WEAVING **9 Hours**

Objectives of warping, material flow in beam warping and creels used in warping machines; sectional warping machines.

objectives of sizing; sizing materials and recipes used for different types of fibers; sizing machines; control systems used in sizing machine; sizing filament yarns; concept of single end sizing

SHUTTLE WEAVING **9 Hours**

Objectives and working principles – primary, secondary and auxiliary motions; Types of looms – Handloom, Non-automatic, Semi-automatic and Automatic looms; Drop box looms; Terry loom, mechanisms of Tappet, Dobby and Jacquard weaving.

SHUTTLELESS WEAVING **9 Hours**

Basic principles of various shuttleless weaving machines – Projectile, Rapier, Air-jet, Water-jet, Multi-phase; productivity and techno-economics of these machines.

PROCESS CONTROL IN WEAVING **9 Hours**

Process and quality control measures in pirn winding, cone winding, beam warping, sectional warping, sizing, and weaving. Computerised fabric inspection, Loom data system.

TOTAL: 45 HOURS

REFERENCES

1. Allan Ormerod, Walter S. Sondhelm, Weaving-Technology and Operations, Textile Institute Pub., 1995.
2. Lord P.R. and Mohammed, Weaving: Conversion of yarn to fabric, M.H. Merrow Pub. Co Ltd., U.K., 1998.
3. Talukdar, Introduction to winding and warping, Mahajan Pub. (P) Ltd., 1998.
4. Talukdar, Wadekar and Ajgaonkar, Sizing–Materials, methods and machines, 2nd edition, Mahajan Pub. (P) Ltd., 1998.
5. Gokarneshan N., Weaving Preparation Technology, Abhishek Pub., 2009
6. Talukdar, Sriramulu and Ajgaonkar, Weaving–Machines, Mechanisms, Management, Mahajan Pub. (P) Ltd., 1998

COURSE OUTCOMES

- Outline the objectives and working principles of various weaving preparatory processes.
- Describe the working principle of automatic and non automatic looms used for fabric manufacture.
- Acquire knowledge on the process and quality control in the preparatory processes as well as in weaving.

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY	L	T	P	C
(Common to all branches of Engineering and Technology)	**0**	**0**	**3**	**1**

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations

U14FT*P*201/ TEXTILE PRODUCTION PROCESS LABORATORY	L	T	P	C
(For Fashion Technology)	0	0	3	1

LIST OF EXPERIMENTS

1. Study of longitudinal and cross sectional view of natural and synthetic fibres
2. Identification of fibres through flammability test.
3. Identification of fibres through solubility test.
4. Determination of moisture regain of fibres
5. Determination of blend proportions of blends
6. Study of blow room
7. Study of carding
8. Study of Draw frame
9. Study of comber and simplex
10. Study of ring frame and Open end spinning.
11. Study of non automatic and automatic looms
12. Study of knitting machines

TOTAL: 45 HOURS

COURSE OUTCOMES

- Ability to identify the given fibre by choosing proper scientific method
- Knowledge of production process methods of yarn and woven and knit fabric
- Acquire Skill to determine the blend proportion

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
   a. Addition of two images
   b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	**1**	**0**	**1**	**1**

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.

Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours
Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours
Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:
- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.Tech - INFORMATION TECHNOLOGY

SEMESTER – II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*203	Materials Science	3	0	0	3
U14EE*T*212	Electrical and Electronic Circuits	3	1	0	4
U14CH*T*203	Chemistry for Circuit Engineering	3	0	0	3
U14IT*T*201	Foundations of Information Technology	3	0	0	3
	PRACTICAL				
U14CH*P*202	Chemistry Laboratory	0	0	3	1
U14EE*P*212	Electrical and Electronic Circuits Laboratory	0	0	3	1
U14IT*P*201	Computer Hardware and Peripherals Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDIT – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 9 Hours

Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS 9 Hours

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 9 Hours

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION 9 Hours

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4. Singapore, 10th Edition, 2010.
5. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

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U14PHT203 / MATERIALS SCIENCE	L	T	P	C
(Common to ECE, EIE, CSE & IT)	3	0	0	3

OBJECTIVES

At end of the course students would be exposed to

- Conducting, super conducting, magnetic and dielectric materials in electrical devices.
- Semi conducting, optical and new engineering materials in switching and display devices, data storage.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducters: Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory .

Dielectric Materials: Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS AND NANOTECHNOLOGY 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

OPTICAL MATERIALS 9 Hours

Optical properties of semiconductors – Excitons- Traps – colour centre – Types of colour centres – luminescence – fluorescence and phosphorescence - liquid crystal display – Dynamics scattering display – Twisted nematic crystal display – Non- linear materials – second harmonic generation – optical mixing – optical phase conjugation.

TOTAL: 45 HOURS

REFERENCES

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003
2. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
3. Palanisamy P.K., Materials Science, 2nd edition, Scitech Pub. India, (P) Ltd., Chennai, 2003.
4. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003 (Units: 1,2).
5. Rajendran V., Marikaniv A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd., 2004 (Units: 3,4,5).

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials for engineering practice.
- Recognize the various nanomaterials for engineering and technological applications

U14EE*T*212/ ELECTRICAL AND ELECTRONIC CIRCUITS	L	T	P	C
(Common to CSE & IT)	3	1	0	4

OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

DC CIRCUITS **9 Hours**

Electrical quantities – SI units – Circuit elements – Ohm's law – Kirchoff's laws – DC series and parallel circuits – Mesh and nodal analysis – Star to delta conversions – Simple problems.

AC CIRCUITS **9 Hours**

Sinusoidal excitation – RMS , Average and Peak values – Phasor representation – Power factor – Single phase RC,RL and RLC circuits – Series and Parallel resonance – Introduction to three phase circuits: V, I and P equations – Simple problems.

SEMICONDUCTOR DIODE AND APPLICATIONS **9 Hours**

N and P type semiconductors – PN junction – Biasing – VI characteristics – Diode operation – Rectifiers – Half wave, Full wave , Bridge rectifiers – Power supply filters – Zener diode – Applications – Optical diode.

TRANSISTORS AND APPLICATIONS **9 Hours**

Transistors – Operation, Characteristics, Biasing – BJT amplifiers – CE – CB – CC – Multistage amplifiers – JFET, MOSFET – Characteristics, Biasing – SCR – Phototransistor.

OSCILLATORS AND OPERATIONAL AMPLIFIERS **9 Hours**

Principle of oscillators – RC feedback Circuits – LC feedback circuits – Relaxation oscillators – Introduction to Operational Amplifiers – Input modes and Op- amp parameters – Op-amp with negative feedback – Comparator – Summing amplifier – Integrator and Differentiator.

L: 45 Hr T: 15 Hr TOTAL: 60 HOURS

REFERENCES

1. Edminister and Nahvi, Electronic Circuits, Schaum's outlines, Tata MCGraw – Hill, 1999.
2. Robert L. Boylested and Louis Nahelsky, Electronic Devices & Circuit theory, 7th Edition, Prentice Hall, 1999.
3. Choudhury R. and Jain S., Linear Integrated Circuits, 3rd edition, New Age Pub., 2007.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2004.
5. Muthusubramaniam R., Salivahanan S. and Muraleedharan K.A., Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2nd edition, 2006
6. Thomas L. Floyd, Electronic Devices, 6th edition, Pearson Education, 2003

COURSE OUTCOMES

- Define & identify the basic electrical quantities and also able to calculate approximately the voltage, current parameters in DC circuits using basic laws.
- Understand the phasor representation of various AC circuit parameters and acquire knowledge on fundamentals of three phase ac circuits.
- Differentiate the various semiconductor diodes and rectifiers
- Summarize the characteristics of different types of transistors.
- Apply the achieved basic knowledge about oscillators & op-amp to different dc applications.

U14CH*T*203/ CHEMISTRY FOR CIRCUIT ENGINEERING	L	T	P	C
(Common For ECE, EEE, EIE, IT)	**3**	**0**	**0**	**3**

OBJECTIVES

To impart a sound knowledge on basics of

- Theoretical and modern technological aspects of modern polymeric materials technology for micro electrical, electronics, instrumentation and communication fields.

INTRODUCTION TO CONDUCTING POLYMERIC MATERIALS 9 Hours

Formation of polymers – Types of polymers - chain growth and step growth polymerization – Mechanisms - copolymerization - Thermoplastics and thermosets - Micro structures in polymers – polymer length - molecular weight - amorphous and crystalline - thermal transitions in plastics.

APPLIED CONDUCTING POLYMERS 9 Hours

Synthesis, structure, morphology, conductivity, doping theory and uses of Poly(sulfur nitride), polyacetylene, polyphenylene, poly(phenylene vinylenes), poly(phenylene sulfide), Polypyrrole and Polythiophene, Polyaniline - Polymers with transition metals in the side-group structure and their uses (includes Stacked Phthalocyanine polymers).

MANUFACTURING METHODS OF ORGANO ELCTRONICS MATERIALS 9Hours

Organo-electronic materials – classification – Production of substrates for organic electronics - Reel-to-reel Vacuum metallization - Organic vapor phase deposition – production of TFTs, OLED, organic photovoltaics - Micro and nanofabrication techniques – Solution based printing.

ORGANIC ELECTRONIC MATERIALS 9 Hours

Organic thin-film transistor (OTFT) – architecture, operating mode - fabrication techniques - structure-property relationship - Methods of improving performance – structural perfection - device architecture - Electrical and environmental stability – chemical effects on stability - Gate dielectrics on electrical functionality.

ADVANCED MATERIALS FOR ORGANIC ELECTRONICS 9 Hours

Pentacene transistors – performance - Engineered pentacenes – Reversible functionalization – end - substituted derivatives - perifunctionalized pentacenes – Heteropentacenes - Semiconductors based on polythiophene and Indolo[3,2-*b*]carbazole – polydialkylterthiophenes – polydialkylquaterthiophenes - polythiophene nanoparticles - indocarbazole designs.

TOTAL: 45 HOURS

REFERENCES

1. Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, Functional Monomers and Polymers, CRC Press, New York.
2. Kaiser A.B., Electronic properties of conjugated polymers, Basics models and applications, Springer verlag, Berlin.
3. Chilton J.A. and Goosey M.T., Special polymers for electronics and optoelectronics, Kluwer Academic Pub., London.
4. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley – VCH, Weinheim
5. Hand book of Conducting Polymers, e-book
6. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, Polymer Science, New Age Int. Pvt. Ltd., New Delhi

COURSE OUTCOMES

- Analyse and determine the required conducting polymers in fabrication of organic electronic devices
- Describe the mechanism of formation of conducting polymeric materials
- Design an Organic Thin film transistor
- Outline the performance of Pentacene transistors

U14ITT201/ FOUNDATIONS OF INFORMATION TECHNOLOGY	L	T	P	C
(Common to CSE & IT)	3	0	0	3

OBJECTIVES

- Acquire an overview of data storage and manipulation in computers
- Understand the basic concepts of operating systems , networks and database
- Know the applications of Internet and Information Technology

Computer Basics and Architecture **11 Hours**
Computer Organization and Architecture: Introduction-CPU-Communication among various units - Instruction Format-Instruction Cycle-Instruction Set-Data Representation in Computers.
Computer Memory and Storage: Memory Hierarchy-Types of Memory-CPU interaction with memory-Secondary Storage devices and its types

Basics of Operating Systems and Databases **10 Hours**
Operating systems: Evolution-Types of Operating System –Functions of Operating System-Coordinating machine activities-Handling competition among processes
Database Fundamentals: Logical and Physical Data Concepts- Database Management System-Architecture-Database Models-Types of databases.

Basics of Networks and Data Communication **08 Hours**
Networks-Network Topologies-Communication Protocol-Network devices
Data Communication: Introduction-Data Communication-Transmission Media-Modulation-Multiplexing-Switching

Basics of Data abstraction and Software Engineering **11 Hours**
Data abstraction: Basic data structures - Implementation - Classes and objects - Object Oriented Programming
Software Engineering: Lifecycle-Methodologies-Modularity-Quality Assurance-Documentation-Software Ownership and Liability

Current and Future trends in IT **05 Hours**
E-Commerce- EDI-Wireless Application Protocol-Smart Card- IPTV-Blogging-RFID-Brain Computer Interface

TOTAL: 45 HOURS

REFERENCES

1. Introduction to Information Technology, Pearson Education, ITL Education solutions Ltd., 2012
2. Glenn Brookshear J., Computer Science: An Overview, 11th edition, Pearson Education, 2012.
3. Rajaraman V., Introduction to Information Technology, 2nd edition, PHI Learning Private Limited, 2013.

COURSE OUTCOMES

- Outline various functional components of computer system.
- Summarize the functions of operating systems
- Define different types of network topologies and protocols.
- Explain the various internet tools and terminology.
- Explain the basic concept of data abstraction, database, software engineering.

U14CH*P*101/ U14CH*P*201 CHEMISTRY LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc

U14IT*P*201/ COMPUTER HARDWARE AND PERIPHERALS LABORATORY	L	T	P	C
(For Information Technology)	0	0	3	1

OBJECTIVES

- Acquire in-depth practical knowledge of the computer hardware and computer networks.
- Understand the assembly of PC and connection of networks
- Develop skill related to the trouble shooting and configuration of PC.

LIST OF EXPERIMENTS

1. Study of different types of cables and network topologies
2. Study of different types of network devices
3. Study and identification of Major parts of PC
4. Assembly and Disassembly of PC
5. Connecting a small LAN
6. IP configuration and Subnet masking.
7. Study and troubleshoot the boot process
8. Installation and configuration of Windows 2000
9. Implementation of Wireless Network
10. Study, Identification, Assembly and Disassembly of Printer and Monitor

TOTAL: 45 HOURS

COURSE OUTCOMES

- Explain the various computer hardware components and their functionality. [S]
- Illustrate the assembling process of a computer system. [S]
- Explain the local area network and file sharing methods. [S]
- Perform the installation of Windows and Linux operating system. [S]
- Explain the configuration of wireless adapter. [S]

U14EE*P*212/ ELECTRICAL AND ELECTRONIC CIRCUITS LABORATORY	**L**	**T**	**P**	**C**
(For Computer Science)	**0**	**0**	**3**	**1**

OBJECTIVES

- To study the characteristics of resonant circuits
- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Laws
2. Series & Parallel Resonance
3. Power Measurement in series RLC circuit.
4. Half wave and full wave rectifier
5. Zener diode Regulator
6. Common Emitter Transistor characteristics
7. JFET characteristics
8. Wein Bridge oscillator
9. Comparator, summing Amplifier using Op-Amp
10. Integrator and Differentiator using Op-Amp

TOTAL: 45 HOURS

COURSE OUTCOMES

- Understand and verify the breadboard connections.
- Check the working condition of a cathode ray oscilloscope.
- Understand the basic laws of electric circuits.
- Understand the working of various electronic devices.
- Understand the performance of an amplifier to carryout different operations.

U14IT*P*201/ COMPUTER HARDWARE AND PERIPHERALS LABORATORY	L	T	P	C
(For Information Technology)	0	0	3	1

OBJECTIVES

- Acquire in-depth practical knowledge of the computer hardware and computer networks.
- Understand the assembly of PC and connection of networks
- Develop skill related to the trouble shooting and configuration of PC.

LIST OF EXPERIMENTS

1. Study of different types of cables and network topologies
2. Study of different types of network devices
3. Study and identification of Major parts of PC
4. Assembly and Disassembly of PC
5. Connecting a small LAN
6. IP configuration and Subnet masking.
7. Study and troubleshoot the boot process
8. Installation and configuration of Windows 2000
9. Implementation of Wireless Network
10. Study, Identification, Assembly and Disassembly of Printer and Monitor

TOTAL: 45 HOURS

COURSE OUTCOMES

- Explain the various computer hardware components and their functionality. [S]
- Illustrate the assembling process of a computer system. [S]
- Explain the local area network and file sharing methods. [S]
- Perform the installation of Windows and Linux operating system. [S]
- Explain the configuration of wireless adapter. [S]

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.

Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E - MECHANICAL ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
	THEORY				
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CHT202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14EE*T*211	Basics of Electrical & Electronics Engineering	3	0	0	3
	PRACTICAL				
U14CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14EE*P*211	Basics of Electrical & Electronics Engineering Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	**2**	**0**	**2**	**3**

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1 Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2 Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3 Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4 Singapore, 10th Edition, 2010.
5 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

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U14PH*T*202/ MATERIALS SCIENCE	**L**	**T**	**P**	**C**
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIALS 9 Hours

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005
3. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007
4. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd, 2004
5. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications

U14CH*T*202/ APPLIED CHEMISTRY	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	3	0	0	3

OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION 9 Hours

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS 9 Hours

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE 9 Hours

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY **9 Hours**

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY **9 Hours**

Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

1. Samir Sarkar, Fuels and Combustion, Orient Longman, India.
2. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore.
3. Derek Pletcher and Frank C Walsh, Industrial Electrochemistry, Blackie Academic and Professional, London.
5. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi
6. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi.

COURSE OUTCOMES

- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder

U14ME*T*201/ ENGINEERING MECHANICS	L	T	P	C
(Common to CE, AUE, AE, ME, MCE & TXT)	3	1	0	4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES 9 Hours

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES 9 Hours

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS 9 Hours

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION 9 Hours

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES 9 Hours

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.

U14EET211/ BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
(For Mechanical, Automobile& Biotechnology)	3	0	0	3

OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDEMENTALS **9 Hours**

Electric current and Ohm's law – Resistance and Resistivity – Relation between Voltages, Current, Resistance and Power - Capacitance – Parallel plate capacitor – Energy stored in a capacitor.

ELECTROMAGNETISM **9 Hours**

Magnetic field - Field intensity, magnetic flux , Flux density – Permeability – Magnetic effects of electric current – Magnetic circuit – Faraday's laws of Electromagnetic Induction – Self-inductance and Mutual inductance – Energy stored in magnetic field – Magnetic Hysteresis.

AC-CIRCUITS **9 Hours**

Alternating voltages and current – Sinusoidal waveform – cycle and frequency – RMS value – vector diagram of sine waves of same frequency – Alternating current through Resistance, Inductance and Capacitance – current through series circuits – Power factor – Active and Reactive power – Generation of three phase voltage – Voltages, Currents and Power in Star and Delta connected loads.

ELECTRICAL MACHINES (Qualitative Treatment Only) **9 Hours**

DC motor – Principle of operation – Back-emf and voltage equation – Torque and speed Characteristics of Series and Shunt connected motors – Transformer – Ideal Transformer relationship – Three phase induction motor – Cage rotor and Wound rotor – Principle of operation – Slip – Torque Slip characteristics – Single phase induction motors.

ELECTRONIC CIRCUITS **9 Hours**

Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS

REFERENCES

1. Thomas L Floyd, Electronic Devices, 6th edition, Pearson Education, 2003.
2. Muthusubramanian R., Salivahanan S. and Muraleedharan. K.A., Basic Electrical Electronics and Computer Engineering, Tata Mcgraw Hill, 2nd edition, 2006.
3. Thyagarajan T., Sendur Chelvi K.P. and Rangaswamy T.R., Engineering Basics, Revised 2nd edition, New Age International Pvt. Ltd.
4. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand Publishing, 2012.

COURSE OUTCOMES

- Acquire the knowledge of fundamental laws of electrical and electronics engineering.
- State the definition of magnetic circuits.
- Choose suitable motor for desired application.
- The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
- The learners can verify the truth table of digital logic gates.

U14CH*P*101/ U14CH*P*201 CHEMISTRY LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    a. Addition of two images
    b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14EE*P*211/ BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	L	T	P	C
(For Automobile Engineering)	0	0	3	1

AIM

To provide experimental skill in the operation of DC, AC machines and Hands on experience in the development of electronic circuits.

OBJECTIVES

- To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
- To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS

1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 HOURS

COURSE OUTCOMES

- The Students will gain the basic knowledge and understanding the concept of AC and DC machines.
- Students will know the working principle, performance characteristics, (Torque, Speed, Efficiency) control and applications of Electrical Machines.
- Students will be able to design and conduct performance experiments in machines and Rectifiers.
- To familiarize the starting methods of all rotating machines.
- Students will be exposed to the practical applications of identify and solve machines related problems.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.
Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.
Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.E - MECHATRONICS ENGINEERING

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*202	Materials Science	3	0	0	3
U14CH*T*202	Applied Chemistry	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14MC*T*201	Electronic Devices and Circuits	3	0	0	3
PRACTICAL					
U14CH*P*201	Chemistry Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14EC*P*207	Electronic Devices and Circuits Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDIT – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	2	0	2	3

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003
3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES
On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**
Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1 Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42^{nd} Edition, 2012. (for Units I to IV).
2 Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3 Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4 Singapore, 10^{th} Edition, 2010.
5 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PH*T*202/ MATERIALS SCIENCE	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIALS 9 Hours

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 HOURS

REFERENCE BOOKS

1. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
2. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005
3. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007
4. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd, 2004
5. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications
- Recognize the basic concepts of strengthening of materials in technological applications

U14CH*T*202/ APPLIED CHEMISTRY	L	T	P	C
(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	3	0	0	3

OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION **9 Hours**

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS **9 Hours**

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE **9 Hours**

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY **9 Hours**

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE AND POWDER METALLURGY **9 Hours**

Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: Simple eutectic system (Ag - Pb, Fe - C system).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 HOURS

REFERENCES

1. Samir Sarkar, Fuels and Combustion, Orient Longman, India.
2. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore.
3. Derek Pletcher and Frank C Walsh, Industrial Electrochemistry, Blackie Academic and Professional, London.
4. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi
5. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi.

COURSE OUTCOMES

- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder

U14ME*T*201/ ENGINEERING MECHANICS	L	T	P	C
(Common to CE, AUE, AE, ME, MCE & TXT)	3	1	0	4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES **9 Hours**

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES **9 Hours**

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS **9 Hours**

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION **9 Hours**

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES **9 Hours**

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.

U14MC*T* 201/ ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
(For Mechatronics Engineering)	3	0	0	3

CIRCUIT THEORY **9 Hours**

Network Theorems: Kirchoff's laws – Thevinin's and Norton's theorems - Superposition theorem. Two port networks: Z Parameters – Y parameters h parameters.

THEORY OF SEMICONDUCTOR DEVICES **9 Hours**

PN junction – diode equation (Derivation not required) – forward and reverse bias – Diode dc and ac resistances – Zener diode – Bipolar Junction Transistor – CE, CB and CC configurations– Biasing of a transistor; fixed bias, collector feedback bias, self bias – FET – Common source and drain characteristics of JFET and MOSFET.

APPLICATIONS OF DIODES **9 Hours**

HW and FW rectifiers – Filters with Capacitior and Inductors -Clippers and Clampers – Voltage Multipliers – Voltage regulators – Zener, series and shunt types.

AMPLIFIERS AND OSCILLATORS **9 Hours**

Small signal amplifiers – h parameter model for low frequencies – Feedback amplifiers, cascading amplifiers, differential amplifier – Oscillators – Hartley and Colpitt oscillators.

OPERATIONAL AMPLIFIERS **9 Hours**

Ideal characteristics – Inverting, Non-inverting – summer – Comparator, Integrator, differentiator – Schmitt trigger – R.C. Phase shift oscillator, Wein Bridge Oscillator – Multivibrators.

TOTAL: 45 HOURS

REFERENCES

1. Albert Malvino and Bates J., Electronic Principles, Tata McGraw- Hill Pub. Company Ltd., 7th edition, 2008.
2. Millman J., Halkias C.C. and Satyabrata Jit, Electronic Devices and Circuits, Tata McGraw Hill, New Delhi, 2nd edition, 2008.
3. Thomas L. Floyd, Electronic Devices, Pearson Education Asia, 5th edition, 2001.
4. William Hayt, Kemmerly J. and Durban S.M., Engineering Circuit Analysis, McGraw Hill Education, 2011.
5. Sudhakar, Shyammohan and Palli S., Circuits and Networks: Analysis & Synthesis, Tata Mc Graw Hill, New Delhi, 4th edition, 2010 (Unit: 1).
6. Salivahanan S., Suresh kumar N. and Vallavaraj A., Electronic Devices and Circuits, Tata Mc Graw Hill publishing company, New Delhi, 2nd edition, 2008 (Units: 2,3,4).
7. Roy Chowdhury D. and Jain Shail B., Linear Integrated Circuits, New Age Int. Pub., 4th edition, 2010 (Unit: 5).

COURSE OUTCOMES

- Use passive elements and basic theorems to solve the electric circuits.
- Relate the basic semiconductor physics to the characteristics and biasing of low powered electronic devices.
- Design regulators and rectifiers using diodes.
- Design amplifiers for oscillators using transistors.
- Use operational amplifiers to solve simple mathematical operations and build conventional vibrators.

U14CH*P*101/ U14CH*P*201 CHEMISTRY LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

<u>LIST OF EXPERIMENTS</u>

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotometry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water by applying the chemical concepts
- Estimate the concentration of solutions by electrochemical methods and apply it in real life situations like blood testing etc

U14CS*P*211/ COMPUTING LABORATORY	L	T	P	C
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    a. Addition of two images
    b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14EC*P*207/ ELECTRONIC DEVICES AND CIRCUITS LABORATORY	**L**	**T**	**P**	**C**
(For Mechatronics Engineering)	**0**	**0**	**3**	**1**

OBJECTIVES

- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits
- To simulate electronic circuits using standard software packages

<u>LIST OF EXPERIMENTS</u>

1. Characteristics of Semiconductor diode and Zener diode
2. Input and Output characteristics of BJT
3. Characteristics of JFET
4. Frequency response of CE amplifier
5. Clipper and Clamper
6. Phase shift and Wein Bridge oscillators using OP-AMP
7. Astable multivibrator using OP-AMP
8. Monostable and Bistable multivibrator using OP-AMP
9. Voltage Regulator (Zener diode, Transistor series and shunt)
10. Half-wave and Full-wave Rectifier with and without filter.
11. Circuit design using software (Multisim, Pspice)
12. Printed Circuit Board (PCB) design and fabrication using (software) for simple circuits.

TOTAL: 45 HOURS

COURSE OUTCOMES

- Construct input output characteristics of electronic devices.
- Measure current voltage resistance capacitance of a given circuit.
- Design and construct regulators, rectifiers, amplifiers and oscillators using electronic devices and operational amplifiers.
- Simulate electronic circuits using software.

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.

Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself **-** Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.

KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

B.Tech - TEXTILE TECHNOLOGY

SEMESTER – II

Code No.	Course Title	L	T	P	C
THEORY					
U14EN*T*201	Functional English II	2	0	2	3
U14MA*T*201	Engineering Mathematics – II	3	1	0	4
U14PH*T*204	Applied Physics	3	0	0	3
U14CH*T*204	Chemistry for Textiles	3	0	0	3
U14ME*T*201	Engineering Mechanics	3	1	0	4
U14TX*T*201	Textile Fibers	3	0	0	3
PRACTICAL					
U14PH*P*201	Physics Laboratory	0	0	3	1
U14CS*P*211	Computing Laboratory	0	0	3	1
U14TX*P*201	Fiber Analytical Laboratory	0	0	3	1
U14GH*P*201	**Family&Professional Values**	1	0	1	1

TOTAL – 32 HOURS **TOTAL CREDITS – 24**

U14EN*T*201/ FUNCTIONAL ENGLISH - II	L	T	P	C
(Common to all branches of Engineering and Technology)	**2**	**0**	**2**	**3**

OBJECTIVES

- To develop reading accuracy and English fluency
- To Employ appropriate formats in writing and effective
- To compare and relate words/sounds and listen for specific information.
- To maximize the elements of spoken ability

INTERPRETATIONAL DEXTERITY **15 Hours**

Homophones and homonyms - Encoding and decoding advertisements - Transcoding Graphical Representations – Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram - Reading brochures, leaflets, instruction manual - Cloze test - Reading Comprehension- Note Making – Linear and non-linear - Book review, Article review

STYLES OF SCRIPTING **15 Hours**

Types of sentences - Concord - Framing Questions – "Wh" questions, Yes/No questions and Question Tags- Modifiers – Dangling, Misplaced, Squinting- Phrasal Expressions- Editing a passage – Punctuation, Spelling, and Common errors - Paragraph Writing – Narrative, Descriptive, Argumentative, Comparative / Contrastive. - Letter Writing – requesting information, explaining a situation, letter of acceptance, declining letter, letter of application and resume - Essay Writing

AUDITORY PROFICIENCY **15 Hours**

Listening to monologues, Listening for general content - Listening to dialogues - Listening to a telephonic conversation - Listening for specific information, numbers, time, duration - Listening to conversations between three or more people- Listening to a group discussion and providing factual information, Intensive listening

ORATORICAL EFFICIENCY **15 Hours**

Discussing studies/interests/friends/families-Describe an object or event - Describing a working mechanism - Justify an opinion / Negotiating views - Argumentative speech about a public issue - Responding to situations and providing solutions - Picture Perception

L: 30 Hr, P: 30 Hr, TOTAL: 60 HOURS

REFERENCES

1. Mark Ibbotson, Cambridge English for Engineering Published by Cambridge University Press, 2008.
2. Barbara H. Foley, Elizabeth R. Neblett, English in Action, Adult & Academic ESL, 2003

3. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley, Speaking Effectively, Cambridge University Press, .1994
4. Henry I Christ, English for the College Boards, Amsco. 1987
5. Dorothy Adams, Everyday English: A Course on Communicative English, Cengage learning, 2009

COURSE OUTCOMES

- Distinguish the application of technical diction for the data interpretation while reading
- Construct technical sentences and compose corporate letters
- Improve listening for inferring technical information
- Develop spoken communication needed for presentations and discussions

U14MA*T*201/ ENGINEERING MATHEMATICS - II	L	T	P	C
(Common to all branches of Engineering and Technology)	3	1	0	4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **9 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem.

L: 45 + T: 15 = 60

REFERENCES

1 Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2 Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3 Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd.,
4 Singapore, 10th Edition, 2010.
5 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
6 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
7 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
8 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

Course Outcomes

After pursuing the above mentioned course, the students will be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- Know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- Evaluate real and complex integrals over suitable closed paths or contours.
- Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

U14PH*T*204 / APPLIED PHYSICS	L	T	P	C
(Common to Textile Technology and Fashion Technology)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course the students would be exposed to

- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.
- Application of ultrasonic and nuclear physics in medicine.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NEW ENGINEERING MATERIALS **9 Hours**

Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA . Ceramics-Classification of ceramics- Fabrication, Properties and application. Biomaterials-Biomechanisim - Classification of Biomaterials-Processing, Properties and applications.

NANO SCIENCE AND PLASMA TECHNOLOGY **9 Hours**

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

Plasma Technology: properties of plasma- types of plasma- thermal and non thermal plasma-Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field.

TOTAL: 45 HOURS

REFERENCES

1. Gopal S., Materials Science, Inder Pub., Coimbatore, 2007.
2. Pillai S.O., Solid State Physics, 5th edition, New Age International Pub., New Delhi, 2003.
3. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2005
4. Rajendran V. and Marikani A., Materials Science, Tata McGraw Hill Pub. Company Ltd., New Delhi, 2004
5. Goldston R.J. and Rutherford P.H., Introduction of Plasma Physics-I, CRC Pub., New York, America, 2000

COURSE OUTCOMES

- Apply core concepts in Materials Science to solve engineering problems
- Illustrate the electrical / thermal conductivity of semiconductors and determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor,
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the concepts of nanomaterials and modern materials for explaining surface properties like adhesion etc. in engineering practice.
- Identify methods for etching of fabrics

U14CHT204 / CHEMISTRY FOR TEXTILES	L	T	P	C
(Common to Textile Technology and Fashion Technology)	3	0	0	3

OBJECTIVES

- To correlate theoretical principles with application oriented studies
- To embark on the usage of theoretical and modern technological aspects in polymers and dyes to exhibit engineering and technical concepts as required for Textile and Fashion Technology students.

WATER TECHNOLOGY **9 Hours**

Disadvantages of hard water in textile industries – Conditioning methods : external treatment (Ion exchange method), internal treatment (colloidal, phosphate, calgon & carbonate methods) – desalination (reverse osmosis and electro-dialysis) – Common effluent treatment.

POLYMERS **9 Hours**

Introduction – Degree of polymerization – functionality – tacticity - classification based on source, application, thermal properties (thermosetting and thermoplastics) - effect of polymer structure on properties – types of polymerization (addition, condensation, co-polymerization, Ring polymerisation) - mechanism of polymerization (free radical mechanism)

Preparation (mechanism not required) and applications of polythene, polypropylene, polystyrene, polyamides (nylon 6,6), polyesters (PET)

CHEMICAL BONDING **9 Hours**

Ionic, covalent and co-ordinate covalent bonds (overview only) -- hydrogen bonding and its consequences - van der Waal's forces (dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions) - Interaction of enzymes with fibres (basic concepts only). Interaction between fibers and dyes (basic concepts only) - Dyes substrate affinity (dyes for cellulose fibres, silk)

DYES **9 Hours**

Introduction - Classification system of dyes - Chromophore and auxochromes – Important chemical chromophores of dyes classes (azo, anthraquinone, phthalocyanin, Indigoid, polymethine, phthalocyanine, metal complex, Fluorescent) - synthesis of azo dye (Congo red), triaryl methane dye (Malachite green), Anthraquinone dye (Alizarin - 1,2 dihydroxy anthraquinone), Indigoid dye (Indigo), phthalein dyes (Eosin)

ANTHOLOGY OF SPECIALITY CHEMICALS IN TEXTILES 9 Hours

An introduction on chemistry of the following in textiles: Dispersing agents, levelling agents, Retarding agents, Dye fixing agents.

Thermal analysis (DSC): Principle, Instrumentation and application in Textiles

TOTAL: 45 HOURS

REFERENCES

1. Finar I.L, Organic chemistry, Pub. House, UK.
2. Hungar K., Industrial Dyes - Chemistry, properties and applications, Wiley VCH Verlag GmbH & Co., KGaA, Weinheim.
3. Sivaramakrishnan C.N., Anthology of speciality chemicals for textiles, Colour Pub. (P) Ltd., Mumbai, India.
4. Seymour R.B. and Carraher, Polymer chemistry, Plenum Pub. Corporation, New York.
5. Kuriacose J.C. and Rajaram J., Chemistry in Engineering and Technology, Vol. 1 & 2, Tata McGraw-Hill Pub. Co., Ltd., New Delhi.
6. Syed Shabudeen P.S. and Shoba U.S., Chemistry for textiles, Inder Pub., Coimbatore.
7. Amarika Singh, Vairam S. and Suba Ramesh., Chemistry for engineers., Wiley India Ltd., New Delhi
8. Bahl B.S. and Arun Bahl., A Textbook Of Organic Chemistry, S. Chand & Co., New Delhi
9. Hungar K., Industrial Dyes - Chemistry, properties and applications, John Wiley & Sons

COURSE OUTCOMES

- Design a water purifier
- Discuss the mechanism of polymer formation
- Classify dyes and describe its interaction with fibers using bonding.
- Analyse the usage of specialty chemicals in dyes

U14ME*T*201/ ENGINEERING MECHANICS	L	T	P	C
(Common to CE, AUE, AE, ME, MCE & TXT)	3	1	0	4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES **9 Hours**

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES **9 Hours**

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS **9 Hours**

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION **9 Hours**

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES **9 Hours**

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 45 Hr, T: 15 Hr, TOTAL: 60 HOURS

REFERENCES

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES

- Explain the concept of equilibrium of particles and rigid bodies.
- Apply the concepts of equilibrium and moment of inertia for various shapes sections.
- Make use of various concepts of friction.
- Solve problems using the concepts in kinematics and kinetics.

U14TX*T*201/ TEXTILE FIBRES	L	T	P	C
(For Textile Technology)	**3**	**0**	**0**	**3**

OBJECTIVES

At the end of the course the students would be exposed to

- Basic concepts about Textile Fibres
- Basic concepts about Specialty Fibres

INTRODUCTION 9 Hours

Definition of fibre, filament and yarn. Characteristics of fibre forming polymers, molecular weight, orientation and crystallinity. Classification of fibres. Essential and desirable properties of fibres. Concept of thermoplastic and thermoset materials.

NATURAL FIBRES 9 Hours

Vegetable fibres:

Cotton: Development of fibre in seed, morphological & chemical structure, physical & chemical properties and applications.

Chemical constituents, physical, chemical properties and applications of jute and linen fibres.

Animal fibres:

Wool: Types of wool, grading of wool, morphological & chemical structure, physical & chemical properties and applications.

Silk: Types, morphological & chemical structure, physical & chemical properties and applications. Production of silk.

REGENERATED FIBRES 9 Hours

Basic production system of man-made fibres. Merits and demerits of man-made fibres;Viscose rayon: Raw material, physical & chemical properties and applications; Concept of high wet and low wet modulus fibres; Introduction to acetate & triacetate fibres, modal , lyocell and Tencel fibre.

Protein Base: General properties and applications of Caesin, soyabean and zein fibres.

SYNTHETIC FIBRES 9 Hours

Polyamide: Raw material, physical & chemical properties and applications of Nylon6&Nylon 6, 6; Polyester: Raw material, physical & chemical properties and applications. Flame retardant PET, Hygroscopic PET fibre and their applications. Polyacrylonitrile fibre: Raw material, physical & chemical properties and applications of acrylic and modacrylic fibre; Polypropylene and polyethylene: Raw material, physical & chemical properties and applications

SPECIALTY FIBRES AND FIBRE IDENTIFICATION **9 Hours**

Raw material, General properties and applications of Aramid fibre, Carbon, Glass, PVA, Polyurethane, PVC fibre; Identification of textile fibres by microscopic, solubility, flammability and density methods.

TOTAL: 45 HOURS

CASE STUDY:

1. Demographic cultivation and production of cotton fibre in India.
2. Production trend of synthetic fibres for last five years.
3. Worldwide production of high performance fibres.

REFERENCES

1. Vaidya A.A., Production of synthetic fibres, Prentice Hall of India (P) Ltd., New Delhi, 1988.
2. Gupta V.B. and Kothari V.K., Manufactured fibre Technology, Chapman and hall, 1st edition, 1997.
3. Moncrieff R.W., Man made fibres, Butterworths Ltd., 1975.
4. Gordon Cook J., Hand book of Textile fibres, Vol. 1–Natural fibres, CBS Pub. and Distributors, 2005.
5. Gordon Cook J., Hand book of Textile fibres, Vol. 2–Manmade fibres, CBS Pub. and Distributors, 2005.
6. Sreenivasa murthy H.V., Introduction to Textile Fibres, The Textile Association (India) Pub., Mumbai, 1987.
7. Mishra S.P., A Textbook of fibre science and technology, New Age Int., 2000.
8. Gohl E.P.G. and Vilensky L.D., Textile Science, CBS Pub. and Distributors, New Delhi, 2003.

COURSE OUTCOMES

- Classify the textile fibres
- Describe about the properties of major textile fibres
- Compare the fundamental properties of major fibres
- List the end uses of major textile fibres
- Describe about the structure of textile fibres

U14PH*P*101/ U14PH*P*201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
	0	0	3	1

OBJECTIVES

- The experiments are designed to illustrate phenomena in different areas of Physics and to expose you to measuring instruments.
- The laboratory provides a unique opportunity to validate physical theories in a quantitative manner.
- Laboratory experience demonstrates the limitations in the application of physical theories to real physical situations.
- In general, the purpose of these laboratory exercises is both to demonstrate some physical principle and to teach techniques of careful measurement

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations –(Laser,Fiber optics and hysteresis curve)

TOTAL: 45 HOURS

COURSE OUTCOMES

- Determine different physical properties of a material like the thermal conductivity thickness of the material, etc.
- Perform experiments involving the physical phenomena like interference and diffraction.
- Apply physical theories in real life situations by also taking into account its limitations

U14CS*P*211/ COMPUTING LABORATORY	**L**	**T**	**P**	**C**
Common to AE,BIO,CE,EIE,FT,ME,MCE,TXT	**0**	**0**	**3**	**1**

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

List of Experiments

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    a. Addition of two images
    b. Subtraction of two images
10. Write a Matlab program for the following
    a. Read an image and crop
    b. Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

COURSE OUTCOMES

On successful completion of this course the student should be able to

1. Develop static web pages using HTML. [S]
2. Perform basic MATLAB operations. [S]
3. Make use of MATLAB to work with images and graphs. [S]
4. Perform integration and differentiation using MATLAB. [S]
5. Develop team spirit and professional attitude towards the development of simple web applications [A]

U14TX*P*201 / FIBRE ANALYTICAL LABORATORY	L	T	P	C
(For Textile Technology)	0	0	3	1

LIST OF EXPERIMENTS

1. Identification of textile fibres by microscopy method.
2. Studying swelling behavior of cotton/Viscose fibres.
3. Fibre maturity measurement by caustic soda method.
4. Identification of textile fibres by flammability methods.
5. Determination of moisture absorption properties of textile fibres.
6. Identification of textile fibres through solubility test.
7. Determination of blend proportion of given samples.
8. Effect of acids on fibres under various factors (Temperature/Time /Concentration).
9. Effect of alkalis on fibres under various factors (Temperature/ Time / Concentration).
10. Effect of oxidizing agents on fibres under various factors (Temperature/ time/Concentration).
11. Determination of molecular weight of polymers using viscometry.
12. Study of spin finish in manufactured fibres through soxhlet extraction

Creative Evaluation (Any two)

1. Properties of various domestic cotton variety
2. Properties of various imported cotton variety
3. Collection and characteristics analysis of various micro denier fibres
4. Collection and study of modified polyester fibres samples

TOTAL: 45 HOURS

COURSE OUTCOMES

- Identify & distinguish the major textile fibres
- Estimate the moisture regain and blend proportion of textile fibres
- Experiment on effect of temperature, time and concentration on fibre degradation
- Sketch the cross sectional and longitudinal view of major textile fibres
- Evaluate the spin finish percentage of manmade fibre & molecular weight of a polymer

U14GH*P*201/ FAMILY&PROFESSIONAL VALUES	L	T	P	C
(Common to all branches of Engineering and Technology)	1	0	1	1

OBJECTIVES

- To inculcate the basic need for family life and need to maintain peace in it.
- To lead spiritual development through good family life.
- To know the 5C's & 5E's.
- To know the examples for Self Control.
- To practice meditation & Pranayamam.

PEACE IN FAMILY **4 Hours**

Family value: Meaning – Introduction – Essential family values – Greatness of friendship - Family members and their responsibility – Reason for misunderstanding in the family – Individual & family peace – Peace of mind – Vital behavioral requisites.

Greatness of womanhood: Good culture – Cultured behavioral patterns – Love and Compassion.

BLESSING – EFFECTS IN FAMILY **2 Hours**

Introduction - Benefits – Mental Frequency level - Effect of vibrations – Make blessings a daily habit.

Training: Method of blessings.

FOOD IS MEDICINE **2 Hours**

Food is medicine - Healthy food habits- Method of Medicinal food preparations – Food based on character.

PERSONALITY DEVELOPMENT CONCEPTS - 5C'S & 5E'S **4 Hours**

Personality Concepts: Definition - Types of Personality- Personality development activities- Factors affecting personality development - Tools to improve personality- Steps to a dynamic personality-5 C's and 5 E's.

Time Management: Importance –Training.

LEADERSHIP TRAITS & SELF DEVELOPMENT **4 Hours**

Leadership Traits – Carrying oneself - Factors of leadership – Principles of leadership.

Self Development: Importance – Techniques to development oneself– How to develop oneself?–Ten Commandments of self-development– Self-control technique for teenagers.

Training: Method of Self-Control.

SPIRITUAL DEVELOPMENT THROUGH KAYA KALPA YOGA 4 Hours

Spiritual development: Need – Development through Kaya Kalpa - Responsibility of men and women – Need of morality.
KayaKalpa yoga: Aim **-** kayakalpa philosophy - Importance of kayakalpa training.

Training: Kaya Kalpa Yoga.

EXERCISE & MEDITATION 10 Hours

Simplified Physical Exercise & Meditation Practice.

L: 16 Hr, P: 14, Total: 30 Hours

REFERENCES BOOKS:

1. Dr. A. Chandra Mohan, "***Leadership and Management***", Himalaya Publication House,
2. Robert W. Bly, ***"Make Every Second Count",*** Career Press, Incorporated, 2010.
3. Vethathiri's Maharishi's, ***"Manavalakalai part 1,2&3"*** 11th edition, The World Community Service Centre, Vethathiri Publications,1994.
4. Vethathiri Maharishi's, ***"Rejuvenating Life Force and Mind"*** – paper-III for M.A. Yoga for Human Excellence" 3rd edition, The World Community Service Centre, Vethathiri Publications, 2010.
5. Vethathiri's Maharishi's, ***"Yoga for Modern Age",*** The World Community Service Centre, Vethathiri Publications, 2009.
6. Vethathiri's Maharishi's, ***"Genetic Centre",*** The World Community Service Centre, Vethathiri Publications,2003.
7. Swami Vivekananda, "***Selections from the complete works"*** 23th edition , The Ramakirshna Mission Institute of Culture, 2007
8. Vethathiri's Maharishi's, ***"Mind"*** The World Community Service Centre, Vethathiri Publications, 1999.
9. Vethathiri's Maharishi's, ***"Kudumpa Amaithi"*** The World Community Service Centre, Vethathiri Publications, 2001.
10. Russell Kelfer, "Self Control", Tyndale House Publishers, 1985.
11. Swami Vivekananda, "***Karma Yoga"*** 39th edition, The Ramakirshna Mission Institute of Culture, 2008.

COURSE OUTCOMES:

- Behaves as a responsible family member.
- Develop skills for personality improvement.
- Acquire practical knowledge on self-control technique for teenagers.
- Identify the significant of Genetic Centre for the Soul functional base operation.

Department of Biotechnology

Vision

Create a strong teaching base in the area of biotechnology through technical knowledge dissemination to the students and to scale new heights in research by etching the concepts of professionalism, social justice, environmental impact and human ethics for welfare of the general public.

Mission

- ❖ Disseminate a blending of knowledge acquisition and its application in real-life situations to the students
- ❖ Equip the students to adapt to changing global and local needs through well designed curriculum and syllabus
- ❖ Groom students to uphold professional ethics and develop leadership qualities
- ❖ Train students on issues related to social welfare.

PEOs:

PEO 1
Successful professional career and/ or higher studies by gaining knowledge in fundamental mathematics and biological principles (Cognitive objective).

- PEO 1a Growth in professional career
- PEO 1b Record of higher studies

PEO 2
Provide strong foundation in the core biotechnology courses to evaluate real life problems and to propose biotechnological solutions with economical and social viability (Affectionate objective).

- PEO 2a Potentiality to analyze real life problems
- PEO 2b Appropriate biotechnological troubleshoot with economical and social viability

PEO 3 - Sensitize on environmental, health and bioethical issues, Intellectual property rights, professional ethics and life-long learning through application orientated activities (Behavioural objective).

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- PEO 3a Awareness on biotechnological issues and ethics
- PEO 3b Accustomed to life-long learning

POs :

PO1. An ability to apply the knowledge of mathematics, science, and engineering fundamentals in the areas of biotechnology, such as Bioprocess engineering, Genetic Engineering, Bioinformatics, Downstream Processing etc.

PO2. An ability to identify and analyze the complex biotechnology-oriented problems and to nurture the issues by providing appropriate solution

PO3. An ability to design a bio-based system, component or process or protocol to address the essential issues related to public health, environment, society, culture and safety

PO4. An ability to design, analyze, interpret and conclude the biological data using broad research based knowledge

PO5. An ability to educate the appropriate selection and application of current/ modern engineering techniques/ tools in the area of biotechnology

PO6. An ability to inculcate awareness among the students about the impact of various biological issues related to society, ethics, health, culture and safety

PO7. An ability to understand and demonstrate the need for the development of sustainable biotechnological solutions for addressing the environmental issues aligned with society

PO8. An ability to realize, commit and apply professional ethics by means of technology practice

PO9. An ability to inculcate the habit among students to function efficiently as an individual or in multidisciplinary team

PO10. An ability to communicate effectively through verbal and written mode with technical audience

PO11. An ability to create competency in the engineering management, finance principles and its application in multidisciplinary projects

PO12. An ability to recognize the need for life-long learning for sustaining professional career.

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KUMARAGURU COLLEGE OF TECHNOLOGY

COIMBATORE – 641 049

REGULATIONS 2014

B.TECH BIOTECHNOLOGY

CURRICULUM

SEMESTER-III

Code No.	Course Title	L	T	P	C
THEORY					
U14MAT305	Probability and Applied Statistics	3	1	0	4
U14BTT301	Concepts in Biochemistry	3	0	0	3
U14BTT302	Microbiology	3	0	0	3
U14BTT303	Concepts of Industrial Biotechnology	3	0	0	3
U14BTT304	Biochemical Process Calculations	3	0	0	3
U14BTT305	Bioorganic chemistry	3	0	0	3
PRACTICAL					
U14BTP301	Biochemistry and bioorganic chemistry laboratory	0	0	4	2
U14BTP302	Microbiology Laboratory	0	0	4	2
U14BTP303	Industrial Biotechnology Laboratory	0	0	4	2
U14GHP301	Social values	1	0	1	1
	Total Credits				**26**

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SEMESTER-IV

Code No.	Course Title	L	T	P	C
THEORY					
U14GST001	Environmental Science and Engineering	3	0	0	3
U14BTT401	Biotechniques	3	0	0	3
U14BTT402	IPR and Biobusiness management	3	0	0	3
U14BTT403	Fluid and Particle Mechanics in Bioprocess	3	0	0	3
U14BTT404	Cell and Molecular Biology	3	0	0	3
U14BTT405	Biochemical thermodynamics and biophysical chemistry	3	0	0	3
PRACTICAL					
U14BTP401	Biotechniques laboratory	0	0	4	2
U14BTP402	Unit operations laboratory	0	0	4	2
U14BTP403	Cell and Molecular biology laboratory	0	0	4	2
U14GHP401	National & Global values	1	0	1	1
	Total Credits				**25**

SEMESTER-V

Code No.	Course Title	L	T	P	C
THEORY					
U14BTT501	Genetic Engineering	3	0	0	3
U14BTT502	Enzyme Technology	3	0	0	3
U14BTT503	Principles of Bioprocess Engineering	3	0	0	3
U14BTT504	Heat and Mass Transfer in Bioprocess	3	0	0	3
U14BTT505	Immunology	3	0	0	3
U14BTT506	Mammalian and plant cell culture	3	0	0	3

PRACTICAL					
U14BTP501	Mammalian and plant cell culture laboratory	0	0	4	2
U14BTP502	Enzyme Technology laboratory	0	0	4	2
U14BTP503	Genetic engineering laboratory	0	0	4	2
U14BTP504	Immunology laboratory	0	0	4	2
	Total Credits				**26**

SEMESTER-VI

Code No.	Course Title	L	T	P	C
THEORY					
U14BTT601	Bioprocess Control and Automation	3	0	0	3
U14BTT602	Protein structure and Engineering	3	0	0	3
U14BTT603	Biopharmaceutical Technology	3	0	0	3
U14BTT604	Bioreactor analysis and design	3	0	0	3
U14BTT605	Food biotechnology	3	0	0	3
E1	Elective-I (A&B tracks)	3	0	0	3
U14GST007	Professional Ethics	3	0	0	3
PRACTICAL					
U14BTP601	Bioprocess Engineering laboratory	0	0	4	2
U14BTP602	Bioprocess design and simulation laboratory	0	0	4	2
U14ENP401	Communication Skill laboratory	0	0	3	1
	Total Credits				**26**

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SEMESTER-VII

Code No.	Course Title	L	T	P	C
THEORY					
U14BTT701	Advanced Bioinformatics	3	0	0	3
U14BTT702	Downstream Processing	3	0	0	3
U14BTT703	Regulatory, Quality assurance and GMP practices in Biomanufacturing	3	0	0	3
U14BTT704	Industrial Biosafety and Bioethics	3	0	0	3
U14BTT705	Biological Data analysis and Scientific writing	3	0	0	3
E II	Elective-II (A&B tracks)	3	0	0	3
GE	General Elective	3	0	0	3
PRACTICAL					
U14BTP701	Bioinformatics laboratory	0	0	4	2
U14BTP702	Downstream Processing laboratory	0	0	4	2
U14BTP703	Mini Project*	0	0	2	1
U14BTP704	Project (Phase I)	0	0	4	2
	Total Credits				**28**

* Students should conduct mini project during the 3rd year summer vacation

SEMESTER-VIII

Code No.	Course Title	L	T	P	C
THEORY					
E III †	Elective III (C&D tracks)	3	0	0	3
E IV †	Elective IV (C&D tracks)	3	0	0	3
PRACTICAL					
U14BTP801	Project (Phase II)	0	0	18	6
	Total Credits				**12**

For the † courses, students who prefer Fast Track to complete the course work can opt for these courses in 6th and 7th semester respectively as self study courses.

Grand Total Credits: 190

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ELECTIVES FOR SIXTH SEMESTER

Code No.	Course Title	L	T	P	C
Elective I					
U14BTE101	Molecular plant breeding [A]	3	0	0	3
U14BTE102	Conecpts in Food Science [A]	3	0	0	3
U14BTE103	Biofertiliser and biopesticide development and control [A]	3	0	0	3
U14BTE104	Molecular and Microbial Pathogenesis [B]	3	0	0	3
U14BTE105	Forensic biotechnology [B]	3	0	0	3
U14BTE106	Neurobiology and cognitive science [B]	3	0	0	3

ELECTIVES FOR SEVENTH SEMESTER

Code No.	Course Title	L	T	P	C
Elective II					
U14BTE201	Genetic engineering of value added foods [A]	3	0	0	3
U14BTE202	Food Quality And Safety Assurance [A]	3	0	0	3
U14BTE203	Cancer Biology [B]	3	0	0	3
U14BTE204	Stem cells and Tissue engineering [B]	3	0	0	3
U14BTE205	Systems biology [B]	3	0	0	3
U14BTE206	Medical diagnostics & therapeautics [B]	3	0	0	3
General Elective					
U14GST002	Total Quality management	3	0	0	3
U14GST003	Principles of Management	3	0	0	3
U14GST004	Operations Research	3	0	0	3
U14GST005	Engineering Economics and Financial Management	3	0	0	3
U14GST006	Product Design and Development	3	0	0	3

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ELECTIVES FOR EIGHTH SEMESTER

Code No.	Course Title	L	T	P	C
Elective III					
U14BTE301	Nanobiotechnology [C]	3	0	0	3
U14BTE302	Clinical Research & Management [C]	3	0	0	3
U14BTE303	Environmental Toxicology and occupational health [D]	3	0	0	3
U14BTE304	Environmental biotechnology [D]	3	0	0	3
U14BTE305	Thermochemical Conversion of Biomass [D]	3	0	0	3
Elective IV					
U14BTE401	Biomaterials [C]	3	0	0	3
U14BTE402	Structual bioinformatics and Computer aided drug design [C]	3	0	0	3
U14BTE403	Environmental biotechnology risk and impact assessment [D]	3	0	0	3
U14BTE404	Biofuels Engineering [D]	3	0	0	3
U14BTE405	Ecological and Environmental Engineering [D]	3	0	0	3

A- Track A: Agriculture/Food technology
B- Track B: Biomedical science & technology
C- Track C: Applied Biotechnology
D- Track D: Energy & Environmental Biotechnology

ONE CREDIT INDUSTRY ORIENTED COURSES
(5^{th}, 6^{th} or 7^{th} semesters)

Code No.	Course Title	Industry that will offer the course
U14BTIN001	Dairy Technology	Sakthi Dairy, Pollachi
U14BTIN002	Mushroom Technology	Mushroom Foundation of India, Coimbatore
U14BTIN003	Pilot plant and Industrial Fermentors	Golden Bioculture, Tiruchengode
U14BTIN004	Bioethanol	Sakthi Sugars, Appakudal

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SEMESTER III

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U14BTT301 CONCEPTS IN BIOCHEMISTRY

L	T	P	C
3	**0**	**0**	**3**

Objectives:

- To learn about the elements of nutrition
- To learn about the metabolism of carbohydrates, lipids, proteins and nucleic acids and their associated disorders
- To learn about the biochemistry related to physiology and hormones

Course Outcomes

CO1 : Describe the daily requirement and digestion and absorption of carbohydrates, proteins and lipids.

CO2 : Illustrate the metabolic pathways of carbohydrates, lipids and metabolic disorders associated with it.

CO3 : Demonstrate the metabolic pathways of amino acids, nucleic acids and associated disorders.

CO4 : Outline the concepts of physiological biochemistry.

CO5 : Understand the concepts of hormones in human metabolism and their physiological functions.

Pre-requisite:

1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12
CO1			S			S						
CO2	S			W								M
CO3	S											M
CO4	S		M			M						
CO5	S	M										

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
		3	Industry
3	End semester examination	**4**	Alumni

Course Content

ELEMENTS OF NUTRITION 6 Hours

Dietary requirement of carbohydrates, lipids and proteins. Biological value of proteins. Concept of protein quality. Protein sparing action of carbohydrates and fats. Essential amino acids, essential fatty acids and their physiological functions. Digestion and absorption of carbohydrates, proteins and lipids

METABOLISM OF CARBOHYDRATES AND LIPIDS 12 Hours

Introduction to metabolism, Glycolysis, Gluconeogenesis, Pentose Phosphate pathway.TCA cycle – amphibolic pathway. Biosynthesis of polysaccharides – Starch and Glycogen. Blood glucose and its regulation. Biosynthesis of fatty acids, Oxidation of fatty acid – beta oxidation and omega oxidation. Biosynthesis of Cholesterol, Biosynthesis of phospholipids and glycolipids, Metabolism of Xenobiotics

Metabolic disorders of carbohydrate metabolism (pathophysiology, clinical symptoms and treatment) – Diabetes mellitus

Metabolic disorders of lipid metabolism: familial hypercholesterolemia

METABOLISM OF PROTEINS AND NUCLEIC ACIDS 9 Hours

The alanine and glutamine cycle, Formation of Urea, Protein degradation, Protein targeting, Protein folding. Biosynthesis of Purines and Pyrimidines, Biodegradation of Purines and Pyrimidines. Interconnection of pathways of metabolism. Metabolic regulation.

Metabolic disorders of amino acid metabolism: Phenyl ketonuria, Maple syrup urine disease

Metabolic disorders of nucleic acid metabolism: Lesch-Nyhan syndrome

PHYSIOLOGICAL BIOCHEMISTRY 9 Hours

Biochemistry of O_2 and Co_2 Transport, Composition of blood, Lymph and Cerebrospinal fluid, Plasma proteins, Serum Lipid profile, Liver function test, Renal function test. Gastric function test, Normal and abnormal constituents of Urine

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HORMONE BIOCHEMISTRY **9 Hours**

Endocrine glands – Anatomy; Pituitary –organization, chemistry, regulation of secretions of anterior and Posterior pituitary hormones, Pancreas, Thyroid, Adrenal Cortex and Medulla, sex hormones; Clinical orientation.

Theory: 45 Hours **Total Hours : 45**

REFERENCES:

1 David L. Nelson and Michael M.Cox , *Lehninger's Principles of Biochemistry*. 4th Edition, New York ,W.H Freeman & Co, 2007

2 Lubert Stryer , *Biochemistry*, 5th Edition, New York,W.H Freeman & Co., 2003

3 Sathyanarayana. U , *Biochemistry*, Kolkata, Books and Allied (P) Ltd., 2008.

4 Voet and Voet , *Biochemistry*, 3rd Edition, John Wiley & Sons Inc, 2004

5 Murray, R.K., Granner, B.K., Mayes,P.A., Rodwell , V.W., *Harper's Biochemistry*, 29th edition, Prentice Hall International.. 2003.

6 Mathews, C.K. and van Holde, K.E. ,*Biochemistry*, 3rd edition, Benjamin / Cummings Publishing Co. Inc., 2000.

OTHER REFERENCES:

1 https://archive.org/details/LehningersPrinciplesOfBiochemistry5e

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U13BTT302	MICROBIOLOGY	L	T	P	C
		3	0	0	3

Objectives:

- To learn about the microbial world
- To understand different microbes and their morphology and other characteristics.
- To learn about various techniques to control microbes and to apply microbes in allied fields of microbial technology.

Course Outcomes :

CO1 : Comprehend knowledge about historical perspective of microbiology and its developments

CO2 : Recognize the fundamental concepts in the structure and functioning of a cell

CO3 : Demonstrate the microbial nutritional requirements for growth and metabolism

CO4 : Understand the controlling of microbes using physical and chemical methods

CO5 : Acquire knowledge about industrial and environmental microbial applications

Pre-requisite:

1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)											
	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	W				S							
CO2	M	W		W								
CO3	M	W	W		S							
CO4		S										
CO5												

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
		3	Industry
3	End semester examination	4	Alumni

Course Content

HISTORICAL PERSPECTIVE OF MICROBIOLOGY AND MICROSCOPY **9 Hours**

An overview of microbiology including a historical perspective of microbiology, Origin of Leeuwenhoek's Animalcules, Germ theory of fermentation and disease, Development of laboratory techniques to study microorganisms, Developments in disease. Classification and Nomenclature of microorganisms; Basics of Microscopy – light and electron microscopy, Super resolution microscopy, Principles of staining methods to differentiate microbes.

MICROBIAL STRUCTURE AND MULTIPLICATION **9 Hours**

Morphology, Structure and Functional anatomy of Prokaryotic- and Eukaryotic Cells. Multiplication of bacteria, viruses, algae, protozoa and fungi with a special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophage.

MICROBIAL NUTRITION, GROWTH AND METABOLISM **9 Hours**

Nutritional requirements and Microbiological media – chemical elements as nutrients, different media used for culture; Screening and isolation of organisms- Pure culture techniques; Preservation methods, Maintenance of strain improvement (mutant selection, recombinant DNA methods). Definition of microbial growth. Cell division. Growth curve in batch culture or closed system. Different methods to quantify bacterial growth, Aerobic and Anaerobic; Mathematics of growth-generation time and growth rate constant, factors affecting growth. Microbial metabolism-Entner–Doudoroff and Phosphoketolase pathway.

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CONTROL OF MICROORGANISMS AND ANTIMICROBIALS **9 Hours**

Physical and chemical control of microorganisms – sterilization: Moist heat, dry heat, radiation and filtration. Disinfection: phenol, alcohol and detergents; Chemotherapy and antibiotics- anti-bacterial, anti-fungal agents, anti-viral agents, common mode of actions to control microbes and resistance to antibiotics.

APPLIED MICROBIOLOGY – BASIC APPROACH **9 Hours**

Interaction between Microorganisms – Commensalism, Synergism, Mutualism (symbiosis). Lichen symbiosis. Normal flora of human healthy host, host-parasite interactions: Non specific host resistance, importance of nosocomial infections, mode of transmission of airborne pathogens, food and water borne infections caused by bacteria, virus & protozoa; Interactions among soil microbes; Significations of microbes in food; Industrial microbial products and processes.

Theory: 45 Hours **Total Hours : 45**

REFERENCES:

1 Michael J. Pelczar , E.C.S. Chan, *Microbiology* (An Application Based Approach) Tata McGraw Hill; 1st edition, 2010.

2 Talaro, K. P. *Foundations in Microbiology*. 8thEd. NY: McGraw Hill, 2011.

3 Ray, B., Bhuniya, A. Fundamental Food Microbiology, 5th Ed., CRC Press, USA, 2013.

4 Lim D, "*Microbiology*", Second Edition, WCB-Mc Graw Hill, 2001.

5 Talaron K, Talaron A, Casita, Pelczar and Reid , *Foundations in Microbiology*, W.C.Brown Publishers, 2005.

Other References:

1 http://www.austincc.edu/rohde/noteref.htm

2 https://www.studyblue.com/notes/b/microbiology-an-introduction-11th-edition/50936/0

3 http://www.microrao.com/mypgnotes.htm

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U14BTT303	CONCEPTS OF INDUSTRIAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

Objective (s)

- To introduce various types of fermentation
- To learn about the production of primary- and secondary metabolites
- To understand the production of modern biotechnology products

Course Outcomes :

CO1 : Understand about the various industrial bioprocessess

CO2 : Learn the basics of industrial bioprocesses for the production of various primary and secondary metabolites.

CO3 : Apply various modern biotechniques for producing several value added products.

CO4 : Understand the production of biotechnological products.

Pre-requisite:

1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2		S	W		M							
CO3		M			S	W						
CO4		M	W		S							
CO5		S			M	W						

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

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Course Content

INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY **9 Hours**

Introduction to Biotechnology, Colours of Biotechnology, Primary and secondary metabolites, Industrial important microorganisms and microbial products, Basic concepts of upstream and downstream processing, Types and modes of fermentation: Solid state, submerged, batch, continuous, fed-batch, Process flowsheeting - block diagrams, pictorial representation.

PRODUCTION OF SOLVENTS, ORGANIC AND AMINO ACIDS **9 Hours**

A brief outline of processes for the production of industrial important solvents: Ethanol, Acetone-butanol, Glycerol and butanediol, Organic acids: Citric, lactic, acetic, itaconic and gluconic acids, Amino acids: Glutamic acid, lysine and phenylalanine.

PRODUCTION OF ANTIBIOTICS, VITAMINS AND PIGMENTS **9 Hours**

Study of production processes for antibiotics: Penicillin, cephalosporin, streptomycin, tetracyclines, erythromycin and griesofulvin, Vitamins: B_2, B_{12} and C, Pigment: β-carotene, Microbial transformations: Steroids and L-sorbose from D-sorbitol.

PRODUCTION OF BIOMASS AND ENZYMES **9 Hours**

Production of industrial enzymes: Proteases, amylases, lipases, pectinases, xylanases and cellulases; Production of brewer's and baker's yeast, single cell protein, bacterial, fungal, yeast and algal proteins.

PRODUCTION OF BIOTECHNOLOGICAL PRODUCTS **9 Hours**

Biopreservatives (Nisin), Biopolymers (Xanthan gum and PHB), Biopesticides, Biofertilizers, Biofuels (Biodiesel, Biogas and Biooil), Biosurfactants, Overview of modern biotechnological products (Recombinant vaccines, Therapeutic proteins and monoclonal antibodies).

Theory: 45 Hr **Total Hours : 45**

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REFERENCES

1 Casida, L.E., *Industrial Microbiology*, New Age International (P) Ltd, 2005
2 Crueger, W and Anneliese Crueger, Biotechnology: *A Textbook of Industrial Microbiolog*, Panima Publishing Corporation, Edition 2, 2003
3 Sathyanarayana, U., *Biotechnology*, Books and Allied (P) Ltd. Kolkata, 2005.
4 Ratledge C and Kristiansen B. *Basic Biotechnology*, Cambridge University Press, second Edition, 2001.
5 Michael J. Waites. *Industrial Microbiology: An Introduction*, Blackwell Publishing,2001.
6 Stanbury PF, Whitaker A, and Hall SJ, *Principles of Fermentation Technology*, Elsevier Science Ltd., 1995.

OTHERS REFERENCES

1 www.eucodis.com/index.php/company/white-biotechnology
2 http://www.europabio.org/industrial-or-white-biotechnology-driver-sustainable-growth-europe
3 https://www.biotechnologie.de/BIO/Navigation/EN/Background/basics,did=79876.html

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U14BTT304 **BIOCHEMICAL PROCESS CALCULATIONS**

L	T	P	C
3	0	0	3

Objectives:

- To enable the students to understand the applications of basic engineering principles in bioprocesses

Course Outcomes :

CO1 : Remember and understand basic units and calculations in engineering.

CO2 : Apply knowledge on material balances for unit operations in bioprocess industries

CO3 : Apply knowledge on material balances for unit process in bioprocess industries

CO4 : Apply knowledge on energy balances in bioprocess industries

CO5 : Evaluate understanding of yield coefficients in bioprocess industries

Pre-requisite:

1 U14CHT101 Engineering Chemistry

2 U14CHT205 Chemistry for Biotechnology

3 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	P O3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

UNITS, DIMENSIONS AND BASIC CALCULATIONS

9 Hours

Units and Dimensions: Introduction, Dimensions and System of units, Fundamental and derived quantities, Unit conversions, Recommendations for use of units, Dimensional consistency, Dimensional equations; Basic chemical calculations: Introduction, Composition of solid mixtures, solutions and gaseous mixtures, Ideal gas law and its application, Dalton law, Raoult's law, Henry's law.

MATERIAL BALANCES WITHOUT CHEMICAL REACTIONS **9 Hours**

Material balance without chemical reactions: Process flow sheet, Three general methods of solving material balance problems, Material balance of unit operations like distillation columns, extractors, dryers, evaporators, crystallizers and leaching equipments; Recycle, bypass and purge streams.

MATERIAL BALANCES WITH CHEMICAL REACTIONS

9 Hours

Material balance with chemical reactions: Concept of limiting and excess reactants, selectivity, conversion and yield, Recycle, bypass and purge streams, Fuels and combustion – Types of fuels, Calorific value of fuels, Problems on combustion of coal, liquid and gaseous fuels, Air requirement and flue gases, Combustion calculations; Applications of spreadsheet and word processing software in stoichiometry.

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ENERGY BALANCE CALCULATIONS 9 Hours

Thermo physics: Law of conservation of energy, Components of energy balance equations, Heat capacity of solids, liquids, gases and gaseous mixtures, Sensible and latent heat, Thermo chemistry: Enthalpy changes accompanying by chemical reactions, standard heat of reaction, formation and combustion, Effect of temperature on heat of formation and reaction, Absolute enthalpy, adiabatic reactions, thermo chemistry of mixing processes.

STOICHIOMETRY OF CELL GROWTH AND PRODUCT FORMATION 9 Hours

Elemental balances, degrees of reduction of substrate and biomass and available electron balances, Yield coefficients of biomass and product formation, Maintenance coefficients, energetic analysis of microbial growth and product formation, Oxygen consumption and heat evolution in aerobic cultures, Thermodynamic efficiency of growth.

Theory: 45Hours **Total Hours :45**

REFERENCES:

1 B. I. Bhatt and Vora. *Stoichiometry*, 5th edition, New Delhi: Tata McGraw Hill. 2010

2 Shuler M.L. and Kargi F.,"*Bioprocess Engineering: Basic Concepts*", 2nd Edition, New Delhi, Prentice-Hall of India. 2012

3 Pauline M. Doran, "*Bioprocess Engineering Principles*, 2nd Edition, Academic Press. 2012

4 David M.Himmelblau. "*Basic Principles and Calculations in Chemical Engineering*", 6th Edition, New Delhi: Prentice-Hall of India Private Limited. 2007

5 K.V. Narayanan and B. Lakshmikutty. "*Stoichiometry and Process Calculations*", New Delhi: Prentice-Hall of India Private Limited. 2012

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6 J.F. Richardson, J. H.Harker and J. R. Backhurst.. Coulson & Richardson's *Chemical Engineering* Volume-1, 6th edition, United Kingdom: Elsevier. 2007

7 S. K. Ghosal, S. K. Sanyal & S. Datta. "*Introduction to Chemical Engineering*", New Delhi: Tata McGraw Hill. 2006

8 Warren L.Mc Cabe, Julian C.Smith, Peter Harriot. "*Unit Operations of Chemical Engineering*", 7th edition, New Delhi: McGraw Hill. 2012

OTHERS REFERENCES

1 https://www.rug.nl/research/portal/files/6755078/2010BiophysJJol.pdf

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U14BTT305 BIOORGANIC CHEMISTRY

L	T	P	C
3	0	0	3

Objectives:

- To enable understanding chemical principles governing biochemical reactions

Course Outcomes :

CO1 : Understand molecular interaction and chemical reactions of biomolecules
CO2 : Identify synthetic strategies for proteins and oligonucleotides
CO3 : Identify the role of enzymes in organic synthesis
CO4 : Understand the orchestration of events during enzyme catalysis and the role of coenzymes
CO5 : Explain importance and influence of metal ions on protein function

Pre-requisite:

1 U14CHT101 Engineering chemistry
2 U14CHP101 Chemistry Lab
3 U14CHT205 Chemistry for Biomolecules
4 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S			M								
CO2				S								
CO3		M	M		M							
CO4		S										
CO5					M							

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

CONCEPTS IN BIORGANIC CHEMISTRY 6 Hours

Nature of Bonding in Organic molecules; Weak Molecular interactions in biomolecules – Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction; Role of weak interactions in structural organization of proteins and nucleic acids, Interactions between partial charges –dipole moments, hydrogen bonding, Interactions between biological macromolecules and small molecules. Binding equilibria and the kinetics of binding, applied to small molecules/proteins/DNA

ORGANIC CHEMISTRY OF BIOMOLECULES 9 Hours

Classification of Organic reactions; Mechanisms of SN1, SN2, E1 and E2 reactions; Aromatics: structures/resonance; substitution reactions – mechanisms and directing groups, Acid base properties and pI of amino acids, general reactions of amino acids- side chain, carboxyl and amino group; Chemical reactions of amino acids with Ninhydrin, Sanger's reagent, Edman's reagent and Dansyl chloride Chemistry of carbohydrates – hemiacetal formation and the anomeric effect; Reactions involving reducing property, Synthesis of oligosaccharides Chemical Reactions of fats; Saponification and transesterification reactions of fatty acids; Acid number, Saponification number, Iodine number

SYNTHETIC METHODS FOR BIOMOLECULES 6 Hours

Chemical synthesis of alpha aminoacids, Solid phase peptide synthesis; Peptide sequencing- Edman's degradation; Oligonucleotide chemical synthesis, Chemical methods of DNA sequencing

CHEMISTRY OF NATURAL PRODUCTS 6 Hours

Alkaloids: structural elucidation, synthesis and biological properties of coniine, piperine Terpenoids and Carotenoids : General methods of synthesis of terpeniods; Isoprene rule; Structure and synthesis of menthol, General methods of Anthocyanines and flavones synthesis; Cyanidine chloride and Quercetin, Curcumin, structure and synthesis

MECHANISM OF ENZYME, COENZYME CATALYSIS 6 Hours

Coenzymes in catalysis, Mechanism and role of: pyridoxal phosphate (aminotransferases), NAD/NADP (dehydrogenases), Thiamine pyrophosphate (carboxylases) Case studies of structure and mechanism-Horse Liver alcohol dehydrogenase, alpha –chymotrypsin, hen egg white

lysozyme, Ribonuclease A.
Case study- engineering an enzyme- subtilisin; Case study- allostery ATPase.

SYNTHETIC STRATEGIES AND MOLECULAR MODELS FOR BIOMOLECULES **6 Hours**

Enzymes in organic transformations- hydrolysis of amide bond, esters; reduction of aldehydes and ketones using enzymes and whole cells. Enzymes in organic solvents- ester, lactone and peptide synthesis. Cyclodextrins.

METAL-LIGAND COMPLEXES IN PROTEINS **6 Hours**

Transition metal ions and oxidation states; Types of ligands; Role of iron in Myoglobin, Haemoglobin and cytochromes; Copper in Hemocyanin, Magnesium in chlorophyll, Cobalt in vitamin B-12 and Molybdenum in nitrogenase; Metaloenzymes; Geometrical and optical isomerism in coordination complexes

Theory: 45 Hours **Total Hours :45**

REFERENCES:

1 Morrison and Boyd , *Organic Chemistry* 6th Edition, 1992.
2 Finar, I.L., *Organic chemistry*. Vol-2, 5th edition, 1952.
3 Kalsi.P.S and Jagtap.S *Pharmaceutical, medicinal and Natural Product Chemistry*, Narosa Publishing house, New Delhi, 2013
4 Trevor Palmer .,*Enzymes: Biochemistry, Biotechnology and Clinical Chemistry*, New York, United States.2001.
5 Nicholas C. Price and Lewis Stevens., *Fundamentals of Enzymology*, Third edition, United Kingdom, Oxford University Press. 1999.
6 John McMuray, Second edition .,*Organic chemistry with biological applications*, Texas, Thomson Brooks/Cole. 2011.

OTHER REFERENCES:

1 H. Dugas, H. *Bioorganic Chemistry*, Berlin: Springer Verlag. 1999.
2 Dobson, C. M., Gerrard J. A, Pratt, A. J. *Foundations of chemical biology*, USA: Oxford University Press, 1995.
3 http://nptel.ac.in/courses/104103018/1
4 http://www.saylor.org/courses/chem204/

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U14BTP301	BIOCHEMISTRY & BIOORGANIC CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

Objectives:

- To be able to employ biochemical and chemical methodologies in the quantification, isolation, synthesis, extraction of molecules of biological significance.

Course Outcomes :

CO1 : Isolate biomolecules from plant and animal tissues and carry out analysis
CO2 : Carry out Qualitative and quantitative analysis of metabolites
CO3 : Carry out enzymatic analysis with proper controls
CO4 : Carry out synthesis of bioactive molecules;
CO5 : Study molecular properties using invitro and insilico methods

Pre-requisite:

1 U14CHP101 Chemistry Lab
2 U14CHT205 Chemistry for Biomolecules
3 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	S										
CO2		S	M									
CO3			S									
CO4				S								
CO5		S										

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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Course Content
BIOCHEMISTRY
1. Extraction, separation and determination of absorption spectra of plant pigments
2. Isolation and estimation of serum cholesterol
3. Qualitative and quantitative analysis of:
    (i) Saliva (α-amylase)
    (ii) Urine (urea, uric acid, phosphate, calcium)
    (iii) Blood glucose - DNS method
4. Experiments on blood
    (a) Estimation of haemoglobin
    (b) Determination of A/G ratio in serum
5. Catalase assay; Anitoxidant assay

BIOORGANIC CHEMISTRY
1. Biomolecule synthesis
Synthesis of aspirin, acetaminophen

2. Biomolecule isolation/extraction:
Extraction of caffeine from tea and lycopene from tomato paste

3. Bioproduct synthesis
Biodiesel preparation
Saponification reactions of vegetable oils

4. Studying molecular property
To determine the specific rotation of given sample of sucrose by using polarimeter.
Analysis of trypsin action
Determination of logP of Organic compounds (eg. Succinic acid)

5. Bioorganic chiral synthesis:
Enzymatic reduction of ethyl acetoacetate to chiral alcohol by yeast cells

6. Insilico studies
Chemical structure drawing and structure analysis using molecular modeling tools

Theory: Nil **Practical: 45 hrs** **Total Hours : 45**

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REFERENCES:

1 Sadasivam.S and Manickam.A., *Biochemical methods*, 3rd edition, New Age International (P) Limited Publisher, 2005.

2 David T.Plummer, *An Introduction to Practical Biochemistry,* 3rd edition, London ; New York: McGraw-Hill, 1987.

3 Fummis B.S., Hannaford A.J., Smith P.W.G.,"*Text Book of Practical Organic Chemistry*", Longman Edition,1995.

4 Vogel's *Text book of Practical Organic Chemistry*. Low price Edition. 2004.

5 Ashutosh Kar, *Advanced Practical Medicinal Chemistry*, New Age International Publishers

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U14BTP302 MICROBIOLOGY LABORATORY

L	T	P	C
0	0	4	2

Ojective(s):

- To understand and learn the basic techniques applicable for the biotech industry

Course Outcomes :

CO1 : Understand and demonstrate the working principles, procedures of microbiology Lab experiments and equipments

CO2 : Observe and practice different types of culture media and broth for microbial cultivation

CO3 : Differentiate microbes using different staining methods

CO4 : Estimate and evaluate the microbial screening, identification and characterization

Pre-requisite:

1 U14BTT201 Biomolecules and Genetics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12
CO1	W				S							
CO2	M	W		W								
CO3	M	W	W		S							
CO4		S										
CO5												

Course Content

1 Lab safety method and Regulations, Principles and methods of sterilization. Sterilization techniques and Study of instruments: Compound microscope, Autoclave, Hot air oven, Laminar Airflow

2 Preparation of media: Media preparation, plugging and sterilization. (NA/NB, PDA/PDB, MRBA, EMB agar, Blood agar, Mac Conkey agar). Nutrient broth, Nutrient agar, slants, soft agar

3 Pure culture technique – Serial dilutions, Pour plate, Spread plate & Streak plate.

4 Measurement of Microbial Size – Micrometry.
5 Quantification of microorganisms by Turbidimetry and Nephelometry – McFarland standards
6 Motility determination – Hanging drop method & Agar gel Stabbing Method
7 Enumeration of bacterial / yeast cells – Viable count, Total count Direct and Indirect methods (Haemocytometer & Total viable counts).
8 Staining methods: Simple, Negative, Acid fast, Gram staining, Spore, Flagella, Capsule and Metachromatic granular staining. Staining of fungus – Lactophenol cotton blue staining.
9 Growth curve, Determination of growth rate and generation time.
10 Anaerobic Cultivation – RCM, Fluid Thioglycolate broth and Anaerobic jar methods
11 Antibiotic sensitivity assay – Disc & Well diffusion method

Case study – Special Interest

1 Effect of pH, Temperature and Salinity on bacterial growth.
2 Slide culture technique for fungi morphology studies

Theory: Nil **Practical: 45 Hrs** **Total Hours : 45**

REFERENCES:

1 Paul A. Ketchum (2001) Microbiology – Concepts and application, Wiley Publications,USA
2 T.Palvannan, S.Shanmugam and T.Sathish Kumar (2005) Lab Manual on Biochemistry Bioprocess & Microbiology- Scitech Publishers, Chennai
3 Barry Chess, Laboratory Applications in Microbiology: A Case Study Approach, 3e 2015
4 By Alfred Brown and Heidi Smith, Benson’s Microbiological Applications, 13e 2014
5 Steven Obenauf and Susan Finazzo, Laboratory Manual for Microbiology Fundamentals: A Clinical Approach,2nd Edition, 2015.
6 Joseph MC Farland, M.D.Jama.The nephelometer:an instrument for estimating the number of bacteria in suspensions used for calculating the opsonic index and for vaccines. 1907; (14):1176-1178

OTHER REFERENCES:

1 http://faculty.washington.edu/korshin/Class-86/MicrobiolTechniques.pdf
2 http://old2.mui.ac.ir/nutr/images/stories/research/microlab%20book%2007.pdf

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U14BTP303	INDUSTRIAL BIOTECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

Objectives:

To carry of industrial process in the laboratory scale

Course Outcomes :

CO1 : Demonstrate about the production of various metabolites

CO2 : Explain the production and estimation of *Spirulina*

CO3 : Choose the materials required for immobilization of cells

CO4 : Explain the isolation of degraders.

Pre-requisite:

U14BTT201 Biomolecules and Genetics

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M			S	W						
CO2	S	M			S	W						
CO3	S	M			S	W						
CO4	S	M			S	W						
CO5												

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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Course Content

1 Algal Culture- S*pirulina*
2 Production and estimation of citric acid from *Aspergillus* culture
3 Production and estimation of lactic acid and lactose
4 Immobilization of yeast cells
5 Preparation of wine
6 Estimation of alcohol by specific gravity method
7 Immobilization of enzymes (Invertase)
8 Isolation of cellulose degraders
9 Isolation of pesticide degraders
10 Production of Gibberellic acid

Theory: -Nil **Practical: 45hrs** **Total Hours: 45**

REFERENCES

1. Sullia S and Shantharam,S, *General Microbiology*, Oxford & IBH Publishing Co, Pvt. Ltd, 2001.

2. Glaser A N & Nilaido H , *Microbial Biotechnology*, W H Freeman & Co. 2000.

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U14GHP301/ SOCIAL VALUES

(Common to all branches of Engineering and Technology)

L	T	P	C
1	0	1	1

OBJECTIVES

(i) To facilitate individuals to realize their social responsibilities

(ii) To help understand self transformation leads to social transformation

COURSE OUTCOMES:

CO1: Adopt and practice social values as his regular duties.
CO2: Take over the social responsibilities.
CO3: Give solutions and to manage the challenging social issues.
CO4: Voluntarily participate and organize social welfare programmes.
CO5: Explore his ideology of techno social issues and provide the best solution.

Pre-requisite: Nil

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1								S				
CO2						M						
CO3								M				
CO4									S			
CO5												M

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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ORIGIN OF SOCIETY **5 Hours**

Evolution of universe: Creation theory,Big bang theory, Evolution theory, Permanence theory - Mithya, Maya – Evolution of living being - Evolution of Man – Formation of society and social values.

Practical: Group Discussion on Evolution of Man and formation of society, Panel discussion on Social values - Pancha Bhoodha Navagraha Meditation.

SELF AND SOCIETY **2 Hours**

Duty to self, family, society and world –Realization of Duties and Responsibilitiesof individuals in the society (Five fold cultures) – impact of social media on present day youth and correction measures.

Practical: Case study – interaction with different professionals.

EDUCATION& SOCIETY **3 Hours**

Education: Ancient and Modern Models.

Practical: Making Short film on impact of education in social transformation.

DISPARITY AMONG HUMAN BEINGS **3 Hours**

Wealth's for humans, Factors leading to disparity in human beings and Remedies.

Practical: Debate on disparity and social values.

CONTRIBUTION OF SELF TO SOCIAL WELFARE **3 Hours**

Participation in Social welfare – Related programmes– Recognized association – Activities for social awareness – Programme by Government and NGOs – Benefits of social service – Balancing the family and social life.

Practical: *In campus, off campus projects.*

GENERAL PRACTICAL **14 Hours**

Ashtanga Yoga: Pathanjali maharishi & Yoga – Involvement – Rules of Asanas -Suryanamaskara (12 Steps)- Meditation.

Standing : Pada Hastasana, Ardha Cakrasana, Trikonasana, Virukchsana (Eka Padaasana)

Sitting : Padmasana, Vakrasana, Ustrasana, Paschimatanasana.
Prone : Uthanapathasana, Sarvangasana, Halasana, Cakrasana,
Supine : Salabhasana, Bhujangasana, Dhanurasana, Navukasana.

Theory:16 Hrs **Practical: 14hrs** **Total: 30 Hours**

REFERENCES BOOKS:

1. Steven , Weinberg, “The First Three Minutes” : A Modern View of the Origin of the Universe (English), Perseus books group,1977.
2. Vethathiri’s Maharishi’s, *“Vethathirian Principles of Life”* The World Community Service Centre, Vethathiri Publications, 2003.
3. Vethathiri’s Maharishi’s, *“Karma Yoga: The Holistic Unity”* The World Community Service Centre, Vethathiri Publications, 1994.
4. Vethathiri’s Maharishi’s, *“Prosperity of India”* The World Community Service Centre, Vethathiri Publications, 1983.
5. Swami Vivekananda, “*The Cultural Heritage of India”* 1st edition, The Ramakirshna Mission Institute of Culture, 1937.
6. Vivekananda Kendra Prakashan Trust, “YOGA”, Vivekanandha Kendra Prakashan Trust,Chennai, 1977.

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SEMESTER IV

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L	T	P	C
3	0	0	3

U14GST001 ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to all branches of Engineering and Technology)

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Play a important role in transferring a healthy environment for future generations

CO2: Analyze the impact of engineering solutions in a global and societal context

CO3: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems

CO4: Ability to consider issues of environment and sustainable development in his personal and professional undertakings

CO5: Highlight the importance of ecosystem and biodiversity

CO6: Paraphrase the importance of conservation of resources

Pre Requisite : Nil.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1						S	S					
CO2						S	S					
CO3							M					
CO4						W	M	W				
CO5	M						M					
CO6						M	W					

Course Assessment methods:

Direct	**Indirect**
Internal tests(I, II, III), Assignment, End Semester Exam	1. Course –End Survey

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INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES **10 Hours**

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

ECOSYSTEMS AND BIODIVERSITY **14 Hours**

ECOSYSTEM : Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids - Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –

BIODIVERSITY : Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

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ENVIRONMENTAL POLLUTION 8 Hours

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT 7 Hours

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness

HUMAN POPULATION AND THE ENVIRONMENT 6 Hours

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

Field Work

Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.,

Theory: 45 Hrs Total: 45 Hours

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REFERENCE

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co., 2013
2. Masters G.M., and Ela W.P., Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India., 2002
4. Trivedi R.K and Goel P.K., "Introduction to Air pollution" Techno-science Pubications. 2003
5. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media. 1996
6. Cunningham, W.P., Cooper, T.H.., & Gorhani E., Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001
7. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998
8. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell science Publishing Co., 2003
9. Syed Shabudeen, P.S. Environmental Chemistry, Inder Publishers, Coimbatore. 2013

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U14BTT401	BIOTECHNIQUES	L	T	P	C
		3	0	0	3

Objectives:

- To provide the students an ability to understand the principles of instrumentation and biotechnology oriented techniques and their applications in the field of biology

Course Outcomes :

CO1 **:** Understand the basics of measurements and different extraction methodologies, and their applications in biotechnology

CO2 **:** Describe the instrumentation and applications of specialized molecular spectroscopic techniques

CO3 **:** Demonstrate the principles and techniques of chromatography and electroanalytical methods and their applications in biotechnology

CO4 **:** Explain the various electrophoretic techniques and their applications in biotechnology

CO5 **:** Understand and interpret the various structural elucidation and radioisotope methods

Pre-requisite:

1 U14CHT101 Engineering Chemistry

2 U14BTT201 Biomolecules and Genetics

3 U14MAT305 Probabilty and Applied Statistics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M	W	M		W						W
CO2	S	W	M	S								S
CO3	S	S	M	S								S
CO4	S	S	M	S								S
CO5	S	M	M	M								M

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

MEASUREMENT BASICS AND EXTRACTION METHODS **9 hours**

Classification of instrumental methods; Concepts of accuracy, precision and limits of detection (LOD); Types of errors – random and systematic; Calibration of instrumental methods – comparison with standards, external and internal standard addition methods; Introduction and significance of signal to noise ratio (S/N); Solvent extraction – introduction and principle; Extraction techniques – batch, stripping or back, continuous and counter-current-current; Principle of solid extraction (Soxhlet); Types - Temperature assisted, pressurized hot water and supercritical fluids based extraction.

SPECTROSCOPIC TECHNIQUES **9 hours**

Flame photometry, nephelometry, spectrofluorimetry, circular dichroism (CD), UV-Vis, IR, FT-IR, and Raman Spectroscopy - principle, instrumentation and applications.

CHROMATOGRAPHY AND ELECTROANALYTICAL METHODS **9 hours**

Factors affecting the resolution of chromatography; Rate and plate theory; Significance of VanDeemter equation; Thin layer chromatography, Supercritical fluid chromatography, Counter current chromatography, HPLC, Ultraperformance liquid chromatography (UPLC) and GC – principle, instrumentation and applications; Oxygen and pH electrodes – principle, instrumentation and applications.

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ELECTROPHORESIS & THERMAL METHOD 9 hours

Electrophoresis – introduction & trouble shooting parameters; Paper, agarose gel, polyacrylamide gel (PAGE), SDS-PAGE – principle, instrumentation and applications; Immuno, pulse field and capillary electrophoresis, and isoelectric focusing – principle and applications; Thermo gravimetric analysis (TGA) – principle, instrumentation and applications.

Case study – PAGE and SDS PAGE

STRUCTURAL ELUCIDATION AND RADIOISOTOPE METHODS 9 hours

Mass spectrometry – principle, instrumentation (electron spray ionization [ESI] & chemical ionization [CI]) and applications; MALDI-TOF – principle and instrumentation; x-ray diffraction and nuclear magnetic resonance (NMR) – principle, instrumentation and applications; Types of radioactive decay; Scintillation counters (ionization and excitation) - principle, instrumentation and applications.

Theory: 45 Hours **Total Hours : 45**

REFERENCES:

1 Gurdeep R. Chatwal and Sham K. Anand. (2012) *Instrumental Methods of Chemical Analysis*. 5th Edition. Himalaya Publishing House, India.

2 B.K.Sharma. (2014) *Instrumental Methods of Chemical Analysis*. 24th revised and enlarged edition. GOEL Publishing House, India.

3 Keith Wilson and John Walker, (2010) *Principles and Techniques of Practical Biochemistry and Molecular Biology*. 7th Edition. Cambridge University Press, U.K.

4 Douglas A. Skoog, F.James Holler and Stanley R. Crough. (2007) *Instrumental Analysis*. 6th Edition. Brooks Cole Publishing Company. USA.

5 Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath. (2014) *Biophysical Chemistry: Principles and Techniques*. Himalaya Publsihing House Pvt. Ltd. India).

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OTHER REFERENCES:

1 Ahuja. S and Jespersen. N (Eds) . Comprehensive Analytical Chemistry: Modern Instrumental Analysis Vol. 47, Elsevier, Netherlands. (2006).
(Google Books)

2 Heftman. E Chromatography. Vol. 69A. 6th Edition, Elsevier, Netherlands. (2004).
(Google Books)

3 Rajbir Singh. Chromatography. 1st edition. Mittal Publication, (2002).
(Google Books)

4 http://nptel.ac.in/courses.php?disciplineId=102

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U14BTT402 IPR AND BIOBUSINESS

L	T	P	C
3	0	0	3

Objectives:

- To provide knowledge on various aspects of intellectual property
- To learn procedures for patenting
- To learn concepts of biobusiness

Course Outcomes : Students will be able to:

CO1 : Understand different forms of Intellectual property.
CO2 : Understand types of patents and patenting system in India.
CO3 : Understand basics of biobusiness
CO4 : Learn different market approval procedure in India
CO5 : Understand group project presentation.

Pre-requisite:

1 U14BTT303 Concepts on Industrial Biotechnology
2 U14BTT301 Concepts of Biochemistry
3 U14BTT302 Microbiology

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	S	W		M							
CO3		M			S	W						
CO4		M	W		S							
CO5		S			M	W						M

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

INTELLECTUAL PROPERTY RIGHTS **9 Hours**

Significance and types of IP- Patents, Trademarks, Copyright, Industrial Designs, Trade Mark, Trade secret and Geographical Indications; International framework for the protection of IP; Objective and functions of GATT, WTO, WIPO and TRIPS; Farmers rights.

INDUSTRIAL BIOSAFETY **9 Hours**

Indian Patent Act 1970- Recent Amendments; Types of patents; Role of a Country Patent office; Patent applications-Forms and guidelines, fee structure, time frames; Types of patent application-provisional and complete specification; Concepts of Prior art; Patent databases-India, USPTO, and EPO.

BIOBUSINESS **9 Hours**

Bio-business – Introduction; new and old biobusiness: Need, Scope, Demand and market potential in India; Agri-biotech products and their demand; Role of innovation in business development.

BIOBUSINESS OPPORTUNITY AND ISSUES **9 Hours**

Biobusiness opportunity area- Health care, Biomedical science, agricultural Biotechnology, Environmental Biotechnology; Issues and challenges-Cultural, ethical, social and economical issues.

BIOBUSINESS AND MARKET APPROVAL **9 Hours**

Basics of economics (for Bio-business) – Introduction to Macro and Micro economics.

Types and Business opportunities; Preparation of business plan; ; Pre-market approval, procedure in India; FDA and FPO approval procedure.

GROUP PROJECT PRESENTATION **9 Hours**

Project survey, market potential analysis; Gap finding and analysis; Case studies of different industries and their strategic planning

Theory: 45 Hous **Total Hours : 45**

REFERENCES:

1 Deepa Goel and Ms Shomini Parashar , (2013), *IPR, Biosafety and Bioethics*, Pearson Education publisher

2 Shaleesha A. Stanley, (2007) '*Bioethics*' Wisdom educational service, Chennai.

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3 Erbisch,F H and Maredia,K M (1998) *Intellectual property rights in agricultural biotechnology* Universities Press (India) Ltd.

4 Singh. K, (2010) “*Intellectual Property Rights in Biotechnology*” BCLI, New delhi.

5 Rajiv Jain and Rakhee Biswas,(1999) *Law Of Patents, Procedure & Practice*,Vidhi Publication

Other References

1 https://cgspace.cgiar.org/bitstream/handle/10568/832/ILRI%20Intellectual%20Property%20Policy.pdf?sequence=1

2 http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html

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U14BTT403	FLUID AND PARTICLE MECHANICS IN BIOPROCESS	L	T	P	C
		3	0	0	3

Objectives:

- To enable students understand the applications of fluid mechanics in bioprocess engineering
- To enable students understand the applications of particle flow in bioprocess engineering

Course Outcomes :

CO1 : Understand and apply the concepts of viscosity measurement in fermentation broth.

CO2 : Learn and apply the applications of packed and fluidized beds in bioprocess industries.

CO3 : Comprehend and apply the size reduction and enlargement principles in bioprocess industries.

CO4 : Understand and apply agitation, separation principles in bioprocess industries.

CO5 : Learn the transportation of solids and fluids.

Pre-requisite:

1 U14BTT304 Biochemical Process Calculations

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

FLUID MECHANICS **9 Hours**

Classification and properties of fluids, Broth rheology, Viscometers, Factors affecting broth viscosity, Pressure and its measurement (Manometers), Fluid dynamics: Streamlines, Reynolds number, Boundary layer, Continuity equation, Euler equation and Bernoulli equation; Hagen-Poiseuille equation and Darcy-Weisbach equation.

FLUID FLOW MEASUREMENT **9 Hours**

Flow measurements: Orificemeter, Venturimeter, Rotameter and Gas flowmeters; Flow through packed beds: Drag coefficient, Laminar and turbulent flow in packed beds; Flow through fluidized beds: Mechanism, types and applications; Valves: Gate, globe and butterfly valves.

COMMINUTION AND SCREENING **9 Hours**

Particle shapes, Determination of mean particle size, and particle size distribution; Comminution: Crushing and grinding, Laws of comminution, Industrial comminution equipments; Screening: Types of screens. Screen effectiveness and efficiency. Particle size analysis using screens; Industrial screening equipments; Size enlargement: Granulation

PARTICLE FLOW **9 Hours**

Agitation and mixing: Purposes of agitation, Mechanism of mixing, Agitation equipments, Flow patterns in agitation, Standard design of agitator, Dimensional analysis for power correlation, Mixing in gassed and ungassed fluids, Scale up criteria for bioreactors; Filtration: Industrial equipments, Filter media and filter aids, Basic theory of filtration; Sedimentation: Mechanism, Industrial equipments.

TRANSPORTATION OF SOLIDS AND FLUIDS **9 Hours**

Transportation of particles: Belt conveyors, Screw conveyors, Pipe conveyors, Bucket elevators; Transportation of liquids: Classification, principles, working and applications of centrifugal and reciprocating pumps, Pumping of slurries; Transportation of gases: Fans, blowers and compressors.

Theory: 45 Hours **Total Hours :45**

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REFERENCES:

1 Warren L.Mc Cabe, Julian C.Smith, Peter Harriot. (2012) "*Unit Operations of Chemical Engineering*", 7th edition, New Delhi: McGraw Hill.

2 C. M. Narayana and B.C.Bhattacharyya, (2014) "Mechanical Operations for Chemical Engineers", Khanna Publishers.

OTHER REFERENCES

1 Noel De Nevers.. *"Fluid Mechanics for Chemical Engineers",* 3rd edition, New Delhi: McGraw Hill. 2012

2 Christie John Geankoplis. "*Transport process and separation process principles*", 4th edition, Prentice Hall of India. 2003

3 S. K. Ghosal, S. K. Sanyal & S. Datta. "*Introduction to Chemical Engineering*", New Delhi: Tata McGraw Hill. 2006

4 J.F. Richardson, J. H.Harker and J. R. Backhurst.. Coulson & Richardson's *Chemical Engineering Volume*-1, 6th edition, United Kingdom: Elsevier. 2007.

5 http://as.wiley.com/WileyCDA/WileyTitle/productCd-0470637749.html

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U14BTT404	CELL AND MOLECULAR BIOLOGY	L	T	P	C
		3	0	0	3

Objective(s):

- To understand cellular organization, transport of molecules cell interactions and signaling
- To describe DNA replication, gene expression at transcriptional and translational level gene regulation and DNA repair mechanisms

Course Outcomes :

CO1 : Recognize the fundamental concepts in the structure and functioning of a cell and membrane transport processes.

CO2 : Interpret precisely the diversified roles of cytoskeletal filaments and infer the cascade of events in signal transduction and their significance

CO3 : Discuss and distinguish the replication of prokaryotic and eukaryotic DNA

CO4 : Explain the synthesis of RNA and post-transcriptional modifications Describe genetic code and protein synthesis

CO5 : Understand the gene regulation, DNA damage and repair mechanisms

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	P O2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S			M								
CO2	S											
CO3	S											
CO4	S		W									
CO5	S	W		M								

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

CELLULAR ORGANIZATION AND MEMBRANE TRANSPORT **9 Hours**

Structural organization of prokaryotic and eukaryotic cells; intracellular organelles in a eukaryotic cell – structure and functions; cell cycle; plasma membrane – structure, composition, properties and functions; membrane transport – passive and active transport, roles of channel proteins, carrier proteins and pumps in membrane transport, bulk transport.

CELLULAR INTERACTIONS AND CELL SIGNALING **9 Hours**

Cell adhesion molecules and formation of cell junctions, cytoskeletal proteins and their role in cellular organization and functions – microtubules, intermediate filaments and microfilaments, autocrine, endocrine and paracrine models of cell signaling; signal transduction cascade – role of signaling molecules, receptors, second messengers and protein kinases.

NUCLEIC ACIDS AND GENOME REPLICATION **9 Hours**

DNA as genetic material – Griffith; Hershey and Chase; Avery McLeod & McCarty experiments. Extrachromosomal DNA, retroviruses, Molecular structure of genes and chromosomes; Conformations of DNA and RNA; DNA replication and control; Unit of replication, Enzymes in replication, Prokaryotic replication; Replication in eukaryotic chromosomes; Replication of telomeres in eukaryotes.

TRANSCRIPTION AND TRANSLATION **9 Hours**

Features of promoters and enhancers; Transcription factors (activators and repressors); Classes of RNA molecules; Types of RNA polymerases; Transcription and its control in prokaryotes and eukaryotes. Post-transcriptional modifications; RNA Splicing, Polyadenylation and Capping, RNA editing, types of RNA -SnRNA & hnRNAs; Antisense RNA , microRNA, and RNA Interference (RNAi), ribozymes. Wobble hypothesis, tRNA activation by amino acyl tRNA sysnthetases, Protein synthesis in prokaryotes and eukaryotes (Initiation, Elongation, and Termination); Inhibitors of Translation; Post-translational modifications.

REGULATION OF GENE ACTIVITY AND DNA REPAIR MECHANISMS **9 Hours**

Principles of gene Regulation in prokaryotes and eukaryotes, Transcriptional Regulation : *Lac* Operon; Tryptophan Operon; Attenuation; Constitutively Expressed Genes, Case study- lambda gene regulation in lytic and lysogenic cycles,gene silencing, PTGS, Introduction to Mutations; Physical, Chemical and Biological Mutagens; Reversion; DNA Repair Mechanisms, Direct Reversal; Excision Repair; The SOS Response.

Theory: 45 Hours **Total Hours :45**

REFERENCES:

1 Harvey Lodish, Arnold Berk, S.L Zipursky, Paul Matsudaira, David Baltimore and James Danell *Molecular Cell Biology*, 4th Edition, New York: W.H Freeman and company,2002.

2 De Robertis, E.D.P and De Robertis E.M.F. *Cell and Molecular Biology*, 8th Edition, New York: Lippincott Williams and Wilkins. (2001).

3 Rastogi, S.C. *Cell Biology*, 2nd Edition, New Delhi: New Age International Publishers. 2004.

4 Friefelder, D., “Molecular Biology”, 2nd Edition, Narosa Publishing House, New Delhi. 2009.

5 Lewin B., “Genes IX” Jones and Bartlett, 2008.

6 Weaver, R.F. “Molecular Biology”, 3rd Edition, McGraw Hill., 2005.

7 Alberts et al., Molecular Biology of The Cell, 6th Eition, Garland Science Publisher, 2015.

OTHER REFERENCES:

1 Waston, J.D. “Molecular Biology of the Gene”, 5th Edition, Pearson Education, 2004.

2 http://www.nature.com/scitable/topic/cell-biology-13906536

3 http://nptel.ac.in/courses/102106025/

4 http://www.dnalc.org/resources/

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U14BTT405	BIOCHEMICAL THERMODYNAMICS AND BIOPHYSICAL CHEMISTRY

L	T	P	C
3	0	0	3

Objective(s):

- To understand the biophysical basic of biological phenomenon
- To understand the application of thermodynamic principles to biological systems

Course Outcomes :

CO1 : Understand concepts of thermodynamics and free energy as applied to biological systems

CO2 : Explain the significance of bioenergetics and oxidative phosphorylation

CO3 : Understand the principles of phase equilibria problems and their applications in industrial biotechnology

CO4 : Understand chemical equilibrium principles as applied to biological equllibria

CO5 : Explain biochemical kinetics and its importance

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry

2 U14BTT305 Bioorganic chemistry

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2		M		M								
CO3		S										
CO4		S										
CO5	S			M								

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

FREE ENERGY CHANGE AND BIOLOGICAL PROCESSES 9 Hours

Laws of thermodynamics; Relationship between equilibrium constant and ΔG; Work and the Gibbs energy change; biological standard state & standard free energy change in coupled reactions. The Gibbs energy of assembly of proteins and biological membranes (Case study), Energy release by ATP (Case study)

BIOENERGETICS AND OXIDATIVE PHOSPHORYLATION 9 Hours

Biological oxidation-reduction reactions, redox potentials,. High energy phosphate compounds, free energy of hydrolysis of ATP and sugar phosphates.
Mitochondrial respiratory complexes, electrochemical gradient, chemiosmotic theory, oxidative phosphorylation, ATP synthase and mechanism of ATP synthesis, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photophosphorylations

SOLUTIONS AND PHASE EQUILIBRIA 9 Hours

Properties of liquids –vapour pressure, viscosity and surface tension. Relationship between vapour pressure and boiling point, freezing point-heat of fusion, Surfacants – effect of sufactants on surface tension. Viscosity and Surface tension in everyday life.
The thermodynamics of phase transition, Phase diagrams, Phase transitions in biopolymers and aggregates, Gas solubility and breathing (Case study), Colligative properties, osmosis, The osmotic pressure of solutions of biopolymers

CHEMICAL EQUILIBRIUM AND ACID-BASE CHEMISTRY 9 Hours

Thermodynamic background, Binding of oxygen to myoglobin and hemoglobin (case study), The response of equilibria to - presence of a catalyst, and effect of

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temperature,
Modern concepts of acids and bases-Arrhenius, Lowry- Bronsted and Lewis concepts. Limitations of each concept. Ionisation constant Ka and pKa of weak acids, pH concept, Buffers-types, buffer action and buffer capacity. Henderson–Hasselbalch equation, preparation of buffers, problems. Buffer action in blood (Case study)

BIOCHEMICAL KINETICS **9 Hours**

Reaction rates, Rate laws and rate constants, Reaction order, Integrated rate laws- 1^{st} order, 2^{nd} order , Pharmacokinetics (case study), The temperature dependence of reaction rates – Arrhenius equation, : Enzymes and the acceleration of biochemical reactions (case study)
Reaction mechanisms (enzymes, protein folding), Reaction dynamics -Collision theory, Transition state theory

Theory: 45 hours **Total Hours : 45**

REFERENCES:

1 Donald, T Hayine, *Biological Thermodyanamics*, Cambridge, 2007.
2 Peter Atkins and Julio de Paula, *Physical Chemistry for Life Sciences*, Oxford Press, 2006.
3 Kensal E van Holde, *Principles of Physical Biochemistry*, W. Curtis Johnson & P. Shing Ho, Prentice Hall, 2005
4 David Sheehan, *Physical Biochemistry : Principles and Applications*, John Wiley, 2009.

OTHER REFERENCES

1 http://casegroup.rutgers.edu/casegr-sh-3.html
2 http://www.cchem.berkeley.edu/gchem130/

U14BTP401 **BIOTECHNIQUES LABORATORY**

L	T	P	C
0	0	4	2

Objective:

- To provide hands-on training in bioanalytical techniques and related instruments which enable the students to solve the issues

Course Outcomes :

CO1	**:**	Validate an experiment using absorption spectroscopy
CO2	**:**	Prepare the buffers using pH metry technique applied in many biotechnology industries
CO3	**:**	Operate the spectrophotometer, flame photometer, nephelometer and fluroimeter for the estimation of bioanalytes
CO4	**:**	Gain the skill in the area of chomatography

Pre-requisite:

1 U14CHP101 Chemistry Lab

2 U14BTP201 Biomolecules and Genetics Lab

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	S		M	S	S					M		S
CO2	S	W	M	S	S	M				M		S
CO3	S		S	S	M	S				M		S
CO4	S	S	S	S	S	S				M		S

Course Assessment methods:

Direct		**Indirect**	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

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Course Content

EXPERIMENTS: 45 hrs

1. Extraction and quantification of bioanalytes from plant sources. Calculation of correlation, precision, validity and LOD (Appropriate software programs can be used)
2. Preparation of buffers and determination of pH of an unknown solution (Biological fluids/ plant sources can be used), and Determination of isoelectric point of an amino acid by pH metric titration with a weak acid/ weak base
3. Estimation of paracetamol by UV- spectrophotometry
4. Estimation of sodium and potassium by flame photometry
5. Estimation of sulphate or urinary proteins by nephelometry
6. Estimation of Aluminum by alizarin red S method using fluorimetry
7. Estimation of calcium by potassium permanganate method using titrimetry
8. Identification of biomolecules by thin layer chromatography (TLC)
9. Isolation of biomolecules using preparative thin layer chromatography (PTLC) (Demonstration)
10. Isolation of molecules using HPLC (Demonstration)
11. **Data Interpretation** – LC-MS or NMR or X-ray diffraction techniques (Demonstration)

Theory: Nil Practical: 45 Hrs Total Hours : 45

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REFERENCES:

1 David T.Plummer. *An Introduction to Practical Biochemistry*. 3rd Edition and 33rd reprint (2008). Tata McGraw-Hill Publishing Company Ltd., India, (1987).

2 S.Sadasivam and A.Manickam. *Bichemical Methods*. 3rd Edition (reprint, 2010). New Age International Pvt. Ltd., Publishers, India, (2007).

3 A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith. *Vogel's Textbook of Practical Organic Chemistry*. 5th Edition. Prentice Hall Pvt. Ltd., India, (1996).

4 Siladitya Behera, Subhajit Ghanty, Fahad Ahmad, Saayak Santra, and Sritoma Banerjee. (2012). *UV-Visible Spectrophotometric Method Development and Validation of Assay of Paracetamol Tablet Formulation*. J Anal Bioanal Techniques 2012, 3:6

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U14BTP402	UNIT OPERATIONS LABORATORY	L	T	P	C
		0	0	4	2

Objective:

- To provide extensive knowledge on various unit operations and flow measuring equipments in bioprocess industries

Course Outcomes :

CO1 : Understand the important of fluid mechanics applications.

CO2 : Experiment and learn the mechanical operations.

CO3 : Understand the heat transfer concept and its applications.

CO4 : Experiment the mass transfer concepts applicable in biotech industries.

CO5 : Understand the safety precautions in industries.

Pre-requisite:

1 U14BTT304 Biochemical process calculations

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M	M		W		S	S			M	S
CO2	S	M	M		W		S	S			M	S
CO3	S	M	M		W		S	S			M	S
CO4	S	M	M		W		S	S			M	S
CO5	S	M	M		W		S	S			M	S

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Course Assessment methods:

Direct		Indirect	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

Course Content

1 Flow measurement – Venturimeter / Orificemeter / Rotameter

2 Flow through pipes – Straight / Annular

3 Pressure drop studies – Packed / Fluidized beds

4 Size Reduction Equipment – Jaw Crusher

5 Screening Equipments – Rotap / Gyratory

6 Filters – Plate and Frame / Vacuum Leaf

7 Batch Sedimentation test with starch

8 Heat Exchangers – Shell and Tube / Double Pipe

9 Distillation – Simple / Steam / Packed

10 Bioleaching of hexavalent chromium using *Acidithiobacillus thiooxidans /* Reverse Micellar Extraction of Acid dyes / Biosorption of reactive dyes

11 To prepare and submit industrial hazards by chemical/electrical/mechanical/dust and their safety precautions

12 To prepare and submit chart of various materials (glass/steel/concrete) used in construction.

Theory:--Hr **Practical: 45 Hrs** **Total Hours : 45**

REFERENCES

1 Warren L.Mc Cabe, Julian C.Smith, Peter Harriot. "*Unit Operations of Chemical Engineering*", 7th edition, New Delhi: McGraw Hill. 2012

OTHER REFERENCES:

1 Christie John Geankoplis. "Transport process and separation process principles", 4th edition, Prentice Hall of India. 2003.

2 www.che.iitb.ac.in/courses/uglab/manuals/labmanual.pdf

3 www.iitk.ac.in/july14mse/data/MSE314A.pdf

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U14BTP403	CELL AND MOLECULAR BIOLOGY LABORATORY	L	T	P	C
		0	0	4	2

Objective(s):

- To familiarize with cell counting and cell separation techniques.
- To acquire practical skills related to DNA/ RNA isolation methods
- To gain hands on experience with action of restriction endonucleases and ligase on DNA

Course Outcomes :

CO1 : Demonstrate cell counting and cell separation techniques

CO2 : Experiment to isolate DNA and RNA from various biological tissues.

CO3 : Analyse and interpret DNA and RNA data.

CO4 : Explain the activity of restriction enzymes and ligation of DNA.

CO5 : Demonstrate bacterial genetics through conjugation experiment and Execute the effect of UV irradiation on bacterial genome

Pre-requisite:

1 U14BTP301 Biochemistry and bioorganic chemistry lab

2 U14BTP302 Microbiology Lab

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	W										
CO2	S	M							S			
CO3			W	M	W				S			
CO4	S											
CO5			M			W						

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Course Assessment methods:

Direct		Indirect	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

Course Content

1. Cells microscopy and measurement/ counting
2. Sonication/ Homogenization of cells followed by differential centrifugation and sub cellular enzyme localization by enzyme marker
3. Preparation genomic and plasmid DNA and analysis DNA using agarose gel electrophoresis
4. Preparation , Purification (PCI method) and Quantification (UV spectrophotometer)
   of DNA of DNA from bacteria/plant/animal sources
5. Preparation and quantification of total RNA
6. Restriction analysis of DNA
7. Ligation of DNA fragments
8. Demonstration of bacterial conjugation
9. Understanding DNA mutation using UV light exposure of bacteria
10. Preparation of Phage lysate and analysis of phage DNA

Theory:-- **Practical: 45 hours** **Total Hours : 45**

REFERENCES:

1 Green and Sambrook, Molecular Cloning A laboratory Manual, CSHL Press, NY, 2012.

2 Sambrook et al., Molecular Cloning: A Laboratory Manual 3rd ed. Cold Spring Harbor Laboratory press, Cold Spring Harbor, NY, 2001.

3 http://www.dnalc.org

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U14GH*P*401/ NATIONAL AND GLOBAL VALUES

(Common to all branches of Engineering and Technology)

L	T	P	C
1	0	1	1

Objective(s):

- To make every individual to realize and practice global values.
- To bring in awareness of Universal brotherhood and protect mother earth

Course Outcome :

CO1: Act as a good and responsible citizen.

CO2: Conserve and protect eco cycle.

CO3: Voluntarily work with global welfare organization and provide solution for global peace.

CO4: Invent his Technical design by considering humanity and nature.

Pre-requisite: Nil

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1								S				
CO2												S
CO3									S			
CO4						M						

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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ROLE OF A RESPONSIBLE CITIZEN **4 Hours**

Citizen - its significance–National and Global perspectives.

Practical: Group discussion on National and Global values.

GREATNESS OF INDIAN CULTURE **2 Hours**

Emerging India – past and present, about Culture, Morality and spirituality– Beauty of Unity in diversity - Impact of western culture in India and Indian culture over other countries.

Practical: Demonstration and impact measurements of simple and good actions.

GLOBAL WELFARE ORGANISATIONS **2 Hours**

Education – Health – Nature – Peace

Practical: Organizing an event linking with one of the Organizations In campus /off campus.

PRESERVING NATURE **2 Hours**

Appreciating the flora and fauna on Earth - Importance of Ecological balance – Conservation.

Practical: Trekking, field visit.

GLOBAL PEACE **4 Hours**

One World and One Humanity - Global Peace.

Global personalities: Thiruvalluvar, Vallalar, Vivekanadar, Mahatma Gandhi,Vethathiri Maharishi – Plans for world peace.

Practical: Group discussion on individual plans for world peace.

GENERAL PRACTICAL **16 Hours**

Simplified physical Exercise – Kayakalpa practice (Follow up practice) – Meditation -

Theory & Practice

Pranayama : Bhastrika, Kapala Bhati, Nadi suddhi, Sikari, Sitali.

Mudhra : Chin Mudhra, Vayu Mudhra, Shunya Mudhra, Prithvi Mudhra, Surya Mudhra, Varuna Mudhra, Prana Mudhra, Apana Mudhra, Apana Vayu Mudhra, Linga Mudhra, Adhi Mudhra, Aswini Mudhra.

Theory: 14 Hrs **Practical: 16hrs** **Total: 30Hours**

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REFERENCES BOOKS:

1. Drunvalo Melchizedek, “The Ancient Secret of the Flower of Life”, Vol. 1, Light Technology Publishing; First Edition (April 1, 1999)
2. Dr.M. B. Gurusamy, “Globalisation – Gandhian Approach” Kumarappa Research Institution, 2001.
3. Vethathiri’s Maharishi’s, *“Karma Yoga: The Holistic Unity”* The World Community Service Centre, Vethathiri Publications, 1994.
4. Vethathiri’s Maharishi’s, *“World peace”* The World Community Service Centre, Vethathiri Publications,1957.
5. Vethathiri’s Maharishi’s, *“Atomic Poison”* The World Community Service Centre, Vethathiri Publications, 1983.
6. Vethathiri’s Maharishi’s, *“The World Order Of Holistic Unity”* The World Community Service Centre, Vethathiri Publications, 2003.
7. Swami Vivekananda, “*What Religion Is”* 41th edition, The Ramakirshna Mission Institute of Culture, 2009.

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SEMESTER V

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U14BTT501 GENETIC ENGINEERING

L	T	P	C
3	0	0	3

Objectives:

- To learn various types of vector-host systems and steps in creating a recombinant DNA molecule
- To gain knowledge on various recombinant DNA techniques and their applications.

Course Outcomes :

CO1 : Understand the steps in recombinant DNA preparation
CO2 : Explain the features of various types of gene cloning vectors
CO3 : Comprehend various types of gene isolation and screening methods
CO4 : Describe and apply molecular techniques
CO5 : Demonstrate the different applications of GMOs

Pre-requisite:

1 U14BTP403 Cell and Molecular Biology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	S	W		M							
CO3		M			S	W						
CO4		M	W		S							
CO5		S			M	W						M

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

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Course Content

BASICS OF RECOMBINANT DNA TECHNOLOGY 9 Hours

Restriction and modifying enzymes, construction of recombinant DNA molecules, transformation of r-DNA molecules into target host organisms; Calcium chloride mediated- electroporation- microinjection- gene gun, selection methods for recombinants; antibiotic resistance - blue & white selection, GFP and Luciferase based selection.

CLONING AND EXPRESSION VECTORS 9 Hours

Cloning vector; properties of a cloning vector, (origin of replication, polylinker region, selectable marker gene) Plasmid Vectors; Lambda phage vectors, phagemid, cosmid, shuttle vector, expression vectors; yeast vectors ,Baculoviral based insect vector- mammalian expression vectors, plant transformation vector; binary vector (Ti plasmid based), high capacity vectors, YAC.

Case study: Latest multipurpose expression vector

GENE CLONING AND EXPRESSION METHODS 9 Hours

Construction of genomic and cDNA libraries, PCR based cloning, differential cloning, positional cloning; Gene targeting-transposon mediated cloning, library screening methods; nucleic acid hybridization based screening , nucleic acid Probe preparation methods -radioactive and non-radioactive -PCR based screening- immunochemical screening, over-expression and purification of recombinant His tag fusion proteins using Ni+ column.

Case study: Discussion on gene cloning and expression from a research paper

MOLECULAR TECHNIQUES AND THEIR APPLICATION 9 Hours

Blotting techniques; Southern-northern-western blotting, Polymerase Chain Reaction (PCR); principle- types- applications of PCR, DNA fingerprinting using molecular markers; RAPD-RFLP-application in plant variety characterization, Automated DNA sequencing, next generation DNA sequencing, RNAi and gene knock-out techniques, gene modification

using site directed mutagenesis, Genome sequencing methods, genomics and its importance, systems biology.
Case study: Use of PCR and RFLP in forensic field.

APPLICATION OF rDNA TECHNOLOGY 9 Hours
Application of genetically modified organisms; medicine-recombinant therapeutic proteins- recombinant vaccines- Molecular Diagnosis of human genetic diseases, pathogenic virus and bacteria, agriculture – Transgenic Bt cotton- round-up ready soybean transgenic crops, Biosafety levels for microbial, plant and animals, safety guidelines and release procedure for GMOs in India, effect of GMOs on environment, patenting of gene sequences and its issues.
Industry Connection: molecular diagnosis of pathogens using PCR

Theory: 45 hrs **Total Hours: 45**

REFERENCES:

1 Clark DP and Pasternick NJ, *Biotechnology*: Aademic Cell Updates, Academic Press, Elsevier, 2012.
2 Glick BR and Pasternick JJ *Molecular Biotechnology: Principles and Applications of Recombinant DNA*, 3rd Edition, ASM press, Eashington, 2003.
3 Brown TA., *Genomes* 2, 3rd edition Bios Scientific Publishers Ltd, Oxford, 2006.
4 Primrose SB., Twyman RM., *Principles of Gene Manipulation and Genomics*, 7th Edition, Blackwell Science, 2006.

OTHER REFERENCES:

1. http://nptel.ac.in/courses/102103013/
2. http://www.lsic.ucla.edu/ls3/tutorials/gene_cloning.html

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U14BTT502	**ENZYME TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Objectives:

- To understand the basics of enzymes and classification and enzyme kinetics
- To study the production, purification and characterization of enzymes
- To study the enzyme applications and biosensors

Course Outcomes :

CO1 Understand the basics of enzymes, nomenclature and classification

CO2 Apply the knowledge to derive the kinetics for enzymes

CO3 Learn and apply the different techniques for immobilization of enzymes and kinetics

CO4 Study and apply the knowledge on design of enzyme reactors

CO5 Discuss the applications of enzymes in different industries and biosensors

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry

2 U14BTT303 Concepts of Industrial Biotechnology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	**Programme Outcomes(POs)**											
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	S		M	M								
CO2	S		S									
CO3	S				S							
CO4	S	S		M								
CO5	S		M									

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Course Assessment methods:			
Direct		**Indirect**	
1	Internal Tests	**1**	Course end survey
2	Model Examination	**2**	Faculty survey
3	Assignments	**3**	Industry
4	End semester examination	**4**	Alumni survey

Course Content

INTRODUCTION TO ENZYMES 9 Hours

Introduction of enzymes; Nomenclature and Classification of enzymes; concept of active site, substrate binding site, allosteric site, and energetics of enzyme substrate complex formation; specificity of enzyme action, Mechanisms of enzyme action, –Enzymes in organic solvents; Introduction to enzyme activity and specific activity - calculations.

ENZYME KINETICS 9 Hours

Kinetics of single substrate reactions - Michelis – Menten equation and Briggs Haldane equation; Estimation of Michaelis – Menten parameters – Lineweaver-Burk plot, Eadie-Hofstee plot and Hanes plot; Bisubstrate reactions – single displacement and ping pong mechanism; multi substrate reactions- King and Altmann equation; types of inhibition– Competitive, Uncompetitive, non competitive and substrate; Allosteric regulation of enzymes, Monod-Changeux-Wyman model.

ENZYME IMMOBILIZATION 9 Hours

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking and covalent binding and their advantages and disadvantages; Applications of immobilized enzymes; Electrostatic Effect, effect of charged and uncharged support, Effect of external and internal mass transfer, Damkohler number, effectiveness factor, Intraparticle diffusion kinetics, Biot number

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PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES **9 Hours**

Production and purification of crude enzyme extracts from plant, animal and microbial sources – Methods of characterization of enzymes – Development of enzymatic assays Case study on production of Papain, Chymosin and cellulase enzymes

ENZYME APPLICATIONS **9 Hours**

Application of enzymes in industries – Food, detergent, leather, wool, brewery, and environment, chemicals processing. Design of enzyme electrodes and their applications as biosensors in industry, health care and environment. Case study - Development of enzyme based biosensors for heavy metal ions determination in water.

Theory: 45hrs **Total Hours :45**

REFERENCES:

1 Trevor Palmer, *Enzymes: Biochemistry, Biotechnology and Clinical Chemistry,* 2nd Edition, Horwood Publishing Limited, United Kingdom, (2007)

2 Ashok Pandey, Collin Web, Carlos Ricard and Christian Larroche, *Enzyme Technology*, 2nd Edition, Springer Science + Business Media Inc. and Asiatech Publishers, Netherlands, 2006

3 Nicholas Price and Lewis Stevens, *Fundamentals of Enzymology,* 3rd Edition, Oxford University Press, India, 2009.

OTHER REFERENCES:

1 Shanmugham.S and Sathishkumar.T, Enzyme Technology, Second edition, India, 2009.

2 http://www.novozymes.com/en/about-us/our-business/what-are-enzymes/Pages/default.aspx

U14BTT503	PRINCIPLES OF BIOPROCESS ENGINEERING	L	T	P	C
		3	0	0	3

Objectives:

- To learn the different types of bioreactors and their components
- To understand microbial growth kinetics in batch, fed-batch and continuous mode
- To study the basics of scale-up criteria for bioreactor

Course Outcomes :

CO1 : Understand the different bioreactors and their applications
CO2 : Discuss and distinguish the medium requirements and optimization methods
CO3 : Explain the sterilization kinetics of medium and equipments
CO4 : Describe batch, fed-batch and continuous cultivation and their kinetics.
CO5 : Understand the scale-up criteria for bioreactors.

Pre-requisite:

1 U14BTT302 Microbiology
2 U14BTT303 Concepts of Industrial Biotechnology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

TYPES AND APPLICATIONS OF BIOREACTORS **9 Hours**

Types and industrial applications of bioreactors – stirred-tank reactor and its ancillaries, bubble-column reactor, packed-bed reactor, fluidized-bed, air-lift reactor and photobioreactor, aeration and agitation, rheology of fermentation fluids, main parameters to be monitored and controlled in fermentation processes.

RAW MATERIALS AND MEDIA OPTIMIZATION METHODS **9 Hours**

Criteria for good medium, Various carbon, nitrogen, minerals, vitamins and other complex nutrients for fermentation industry, Simple and complex media for microbial, plant and animal cells, oxygen requirements, medium formulation for optimal growth and product formation, medium optimization methods-Plackett-Burman design, simplex design and response-surface methodology.

Case study: Enzyme production using Plackett-Burman design

STERILIZATION KINETICS **9 Hours**

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, sterilization of air, design of sterilization equipment for batch and continuous process.

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION **9 Hours**

Modes of operation – batch, fed-batch and continuous cultivation, Simple unstructured kinetic models for microbial growth – Monod model, Growth of filamentous organisms and yeast, Simple structured kinetic models – Compartmental model and single cell model, Product formation kinetics – Leudeking-Piret models, substrate and product inhibition on cell growth and product formation.

Case study: Production of penicillin by fed-batch cultivation

SCALE-UP OF BIOREACTORS **9 Hours**

Scale-up criteria for bioreactors. Major factors involved in scale-up. Scaling-up of mixing systems. Scale-up of aeration/agitation regimes in stirred tank reactors. Scale-up of air-lift reactors.

Case study: Scale-up of a reactor for biological metabolites prowastewater treatment using mixed culture / metabolite production

Theory: 45 Hours **Total Hours :**

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REFERENCES:

1 Shuler M.L. and Kargi F, "*Bioprocess Engineering: Basic Concepts*", 2nd Edition, New Delhi, Prentice-Hall of India, 2002.

2 Stanbury P. F., Hall S. and Whitaker A, "*Principles of Fermentation Technology*", 2nd Edition, Butterworth-Heinesmann, 2003.

3 Blanch H. W. and Clark D. S, "*Biochemical Engineering*" , 2nd Edition, CRC Press, 2007.

4 Pauline M. Doran, "*Bioprocess Engineering Principles"*, 2nd Edition, Academic Press, 2012.

5 Bailey and Ollis, "*Biochemical Engineering Fundamentals*", 2nd Edition, McGraw-Hill, 2010.

OTHER REFERENCES:

1 Rajiv Dutta, "Fundamentals of Biochemical Engineering", Ane Books India, New Delhi, 2008

2 http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029

3 http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf

4 http://link.springer.com/book/10.1007%2F978-1-4684-0324-4

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U14BTT504	HEAT AND MASS TRANSFER IN BIOPROCESS	L	T	P	C
		3	0	0	3

Objectives:

- To make the students understand the applications of heat transfer in bioprocess engineering
- To learn and understand the applications of mass transfer in bioprocess engineering

Course Outcomes :

CO1 : The students would understand the modes of heat of transfer.

CO2 : The students would understand and apply the applications of heat transfer in bioprocess industries.

CO3 : The students would understand the principles of diffusion and apply the concepts of interphase mass transfer in bioreactor.

CO4 : The students would understand and apply distillation and adsorption in bioprocess industries.

CO5 : The students would understand and apply extraction and leaching in bioprocess industries.

Pre-requisite:

1 U14BTT304 Biochemical Process Calculations

2 U14BTT403 Fluid And Particle Mechanics in Bioprocesses

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

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Course Assessment methods:			
Direct		**Indirect**	
1	Internal Tests	**1**	Course end survey
2	Model Examination	**2**	Faculty survey
3	Assignments	**3**	Industry survey
4	End semester examination	**4**	Alumni survey

Course Content

HEAT TRANSFER 9 Hours

Modes of heat transfer; Conduction: Fourier's law, Thermal conductivity of biological materials, Conduction through plane wall, hollow cylinder and hollow sphere, Insulating materials-General properties and applications; Convection: Individual and overall heat transfer coefficients, Dimensional analysis for free and forced convection, Heat transfer to fluids with and without phase change.

HEAT TRANSFER EQUIPMENTS 9 Hours

Heat Exchangers: Basic calculations, Heat transfer configurations for bioreactors, Heat exchangers for sterilization, Compact and extended surface heat exchangers; Mechanism of condensation and boiling; Evaporators: Industrial evaporators, Methods of operation, Overall heat transfer coefficient, Single effect evaporator calculations, Evaporation of biological materials.

DIFFUSION AND INTERPHASE MASS TRANSFER 9 Hours

Modes of mass transfer; Diffusion: Fick’s first law, Molecular diffusion in gases, liquids and solids; Interphase mass transfer: Individual and overall mass transfer coefficients for liquids and gases, Theories of mass transfer, Mass transfer in bioreactors: Methods for the determination of k_La, Factors affecting oxygen transfer rate.

DISTILLATION AND ADSORPTION 9 Hours

Distillation: Overview of vapour-liquid equilibria, Flash, differential, continuous, steam, azeotropic and extractive distillation, Determination

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of number of stages by McCabe-Thiele method; Adsorption: Types of adsorption, Nature of adsorbents, Adsorption isotherms-Langmuir and Freundlich, Adsorption kinetics and thermodynamics, Batch and continuous adsorption, Overview of biosorption.

EXTRACTION AND LEACHING 9 Hours

Extraction: Ternary liquid-liquid equilibria, choice of solvent, Single and multistage extraction: Cocurrent and cross current extraction; Leaching: Single stage leaching, Extraction and leaching equipments, Overview of bioleaching.

Theory: 45 hrs Total Hours : 45

REFERENCES:

1 Christie John Geankoplis. "*Transport process and separation process principles*", 4th edition, Prentice Hall of India. 2003

2 N. Anantharaman and K.M. Meera Sheriffa Begum. "*Mass Transfer - Theory and Practice*", New Delhi: PHI Learning Private Limited. 2011

3 Warren L.Mc Cabe, Julian C.Smith, Peter Harriot. "*Unit Operations of Chemical Engineering*", 7th edition, New Delhi: McGraw Hill. 2012

4 S. K. Ghosal, S. K. Sanyal & S. Datta. "*Introduction to Chemical Engineering*", New Delhi: Tata McGraw Hill. 2006

OTHER REFERENCES:

1 Kern.D.Q. "*Process Heat Transfer*, New Delhi: McGraw Hill. 1950

2 Treybal R.E. "*Mass Transfer Operations*, 3rd Edition,"New Delhi: Tata McGraw Hill.1980

3 www.ijppsjournal.com/Vol6Issue1/8095.pdf

L	T	P	C
3	0	0	3

U14BTT505 IMMUNOLOGY

Objectives:

- To learn about the general concepts of immune system and immune organs
- To understand the properties of antigens and antibodies and the concept of antigen-antibody interactions
- To know about the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology.

Course Outcomes :

CO1 : Outline the general concepts of immune system and describe the cells and organs of the immune system

CO2 : Describe the properties of antigens and antibodies with special emphasis on haptens

CO3 : Demonstrate various antigen-antibody interactions and techniques

CO4 : Explain the concept of cell mediated immunity and complement system

CO5 : Illustrate the mechanisms behind hypersensitivity and transplantation immunology

Pre-requisite:

1 U14BTT404 Cell and molecular biology

CO/PO Mapping
(S-Strong, M-Medium, W-Weak)

COs	Programme Outcomes(POs)											
	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S		M									S
CO2	S			W								
CO3	S	M			S							
CO4	S											
CO5			S									

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

CELLS AND ORGANS OF IMMUNE SYSTEM 9 Hours

Historical background, general concepts of the immune system. Innate and adaptive immunity. Structure, properties and functions of the immune cells & organs: Hematopoeisis, T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils Mast cells and dendritic cells. Thymus and bone marrow; Lymph nodes, spleen, MALT, GALT and CALT.

ANTIGENS AND ANTIBODIES 9 Hours

Antigens and haptens; Properties; Adjuvants. B and T cell epitopes. T-dependent and T- independent antigens. Antibodies: Classification, Structure, function and properties of the antibodies; Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiotype).

TECHNIQUES OF ANTIGEN-ANTIBODY INTERACTIONS 9 Hours

Immunological principles of various reactions and techniques: Affinity and avidity, cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA -types, Western Blotting. Hybridoma technology-Monoclonal antibodies production and applications.

CELL MEDIATED IMMUNITY & COMPLEMENT 9 Hours

Major histocompatibility gene complex: Organization of MHC- Types and Functions, Structure and cellular distribution of HLA antigens. Cell mediated immunity: Cell types (CTLs, NK cells, macrophages and TDTH cells), effector mechanisms and effector molecules of cell mediated

reactions. Cytokines – interleukins and interferons (outline only).Complement system: Components of the complement activation - classical, alternative and lectin pathways. Biological consequence of complement activation and complement deficiencies.
Case study - Applications of monoclonal antibodies as immunodiagnostics.

HYPERSENSITIVITY & TRANSPLANTATION IMMUNOLOGY **9 Hours**

Hypersensitivity: Types and mechanism of hypersensitive reactions Autoimmunity: Mechanisms of induction of organ specific and systemic, autoimmune diseases. Therapeutic approach. Transplantation immunology: Types of grafts, immunologic basis of graft rejection, properties and types of rejection, tissue typing, immunosuppressive therapy. Immunity and tumors: Types of tumors, tumor antigens (TSTA and TATA), immune response to tumors.
Case study - Tumor immunology

Theory: 45 hrs **Total Hours : 45**

REFERENCES:

1 Kuby, J. H. (2007). Immunology, 6th Edn., W. H. Freeman Publication, New York, USA
2 Abbas, K. A., Litchman, A. H. and Pober, J. S. (2007). Cellular and Molecular Immunology, 4th Edn., W. B. Saunders Co., Pennsylvania, USA
3 Roitt, I., Brostoff, J. and David, M. (2008). Immunology, 11th Edn., Mosby publishers Ltd., New York, USA
4 Tizard, R.I. (2007). Immunology: An Introduction 1st Edition (English) 4th Edition, Brooks/Cole publishers.
5 Chakaravarthy, A.K. (2006) Immunology and Immunotechnology 1st Edition (English) 1st Edition, Oxford University Press India.

OTHER REFERENCES:

1 http://www.raymondcheong.com/Year1/immuno.html
2 http://ocw.mit.edu/courses/health-sciences-and-technology/hst-176-cellular-and-molecular-immunology-fall-2005/lecture-notes/
3 http://www.umich.edu/~bmsteach/lopatin/Immunology/Immunology.html

U14BTT506	MAMMALIAN AND PLANT CELL CULTURE	L	T	P	C
		3	0	0	3

Objective(s):

- To learn the fundamentals of plant and animal tissue culture.
- To study plant and animal transgenesis.
- To learn gene transfer techniques

Course Outcomes :

CO1 : Outline and learn the basics of plant and tissue culture and requirements to setup the lab

CO2 : Distinguish the direct and indirect gene transfer techniques in plantsand animal cells

CO3 : Apply the techniques for development of transgenic plants and animal

CO4 : Outline and learn the basics of plant animal cell cultures and medium for growth

CO5 : Distinguish and apply the techniques for development of transgenic plants and animals

Pre-requisite:

1 U14BTT201 Biomolecules and Genetics

2 U14BTT302 Microbiology

3 U14BTT404 Cell and Molecular Biology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	S	W		M							
CO3		M			S	W						
CO4		M	W		S							
CO5		S			M	W						M

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

GENERAL REQUIREMENTS FOR CELL CULTURE 9 Hours

Maintenance- Aseptic Laboratory, Aseptic workstation; Precautions to maintain aseptic conditions; challenges in tissue culture; Scope and importance in plant and animal tissue culture; biosafey in cell culture lab.

PLANT TISSUE CULTURE 9 Hours

Plant growth regulators; Preparation of stock solutions- Macro and micro minerals; culturing techniques- Anther culture; pollen culture; root tip culture and advantages and disadavantages; isolation of protoplast; fusion techniques.

PLANT CELL CULTURE TECHNIQUES 9 Hours

Types of tissue culture- Batch, continuous, cell suspension culture, anther culture, root and shoot tip culture, Hairy root culture; concept of turbido stat and chemo stat; Protoplast isolation and fusion; Callus induction and differentiation.

MAMMALIAN CULTURE TECHNIQUES 9 Hours

Scale-up and kinetics of growth and production formation, Serum and serum free media; Types of cell lines; primary culture and establishment of cell line; characterization of cell lines; Cell culture techniques; Measurement of cell death; Cell synchronization, scescene and apoptosis, Measurement of viability and cytotoxicity.; Immobilized cultures; Genetic engineering in animal cell culture; Hybridoma technology.

BIOENGINEERING OF CELL CULTURE 9 Hours

Bioreactor engineering for recombinant protein production from plant suspension culture, Molecular pharming; Applications for producing fine chemicals, drugs, and alternative fuels.

Theory: 45 hrs **Total Hours : 45**

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REFERENCES:

1 Bernard R. Glick, Jack J. Pasternak (2010), *Molecular Biotechnology: Principles and Applications of Recombinant DNA*, ASM press, U.S.A

2 Singh,B.D. (2008) *Text book of Biotechnology*, fourth Edition, Kalyani Publishers, New Delhi.

3 Ranga,M.M (2007), *Animal Biotechnology*, fourth Edition, Agrobios Indialimited, Jodhpur.

4 Rama Dass,P.and Meera Rani S (2007) *Text Book of Animal Biotechnology*, Akshara Printers, New Delhi

5 Masters, J.R.W(2007) *Animal Cell culture. Practical Approach*, Oxford University Press, UK

6 Ian R Freshney (2011) *Animal cell culture: A manual of basic technique and specialized applications*, Wiley and sons.

OTHER REFERENCES:

1 http://www.ncbi.nlm.nih.gov/books/NBK26851/

2 http://www.biotechnology4u.com/question_bank_question_answer.html

U14BTP501	MAMMALIAN AND PLANT CELL CULTURE LABORATORY	L	T	P	C
		0	0	4	2

Objective(s):

- To gain hands on experience in amplify a gene
- To acquire skill preparing recombinant DNA molecule
- To perform DNA fingerprinting using RAPD

Course Outcomes :

CO1 **:** Design and set up plant tissue culture lab.

CO2 **:** Construct and analyse a explants preparation and induxction of callus

CO3 **:** Analyse cell viability test

CO4 **:** Apply basic knowledge on extraction and quatification of mwtabolites from cell lines

CO5 **:** Execute preparation and preservation of cell ine

Pre-requisite:

1 U14BTP403 Cell and Molecular Biology Lab.

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	M		W							
CO2	S	W							S			
CO3	S		W	M					S			
CO4					S							
CO5				M								

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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Course Content

PLANT CELL CULTURE

1. Media Preparation and Sterlizaion
2. Selection of explants and Induction of callus from explants
3. Regeneration of plants from callus and hardening
4. Preparation of Suspension cultures for secondary metabolite production
5. Protoplast isolation and viability staining

ANIMAL CELL CULTURE

6. Animal cell culture media preparation and sterilization
7. Establishment of primary cell line and cell culture
8. Cell viability (Tryphan Blue assay) and cytotoxicity test- (MTT assay)
9. Apoptosis in mouse thymus cells by acridium orange and propidium iodide staining
10. Cryopreservation of animal cells
11. Recovery and purification of industrially importance metabolite from animal cell culture.

Therory: Nil **Practical 45 Hours** **Total Hours : 45**

REFERENCES:

1 Bernard R. Glick, Jack J. Pasternak, *Molecular Biotechnology: Principles and Applications of Recombinant DNA*, ASM press, U.S.A, 2010.

OTHER REFERENCES:

2 Ian R Freshney, *Animal cell culture: A manual of basic technique and specialized applications*, Wiley and sons, 2011.

3 http://www.ncbi.nlm.nih.gov/books/NBK26851/

4 http://www.biotechnology4u.com/question_bank_question_answer.html

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U14BTP502	ENZYME TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

Objectives:

- Provide hands-on training on the assay of different enzymes and kinetics
- To familiarize the students with solid state fermentation and its applications
- To expose the students to the proper handling of fermenters

Course Outcomes :

CO1 : Illustrate partial purification of enzymes

CO2 : Analysis of enzyme activity with soluble enzymes and immobilized enzyme

CO3 : Explain the production and applications of enzymes

CO4 : Demonstrate the bioreactor and modes of operation

Pre-requisite:

1 U14BTP302 Microbiology Lab.

2 U14BTP301 Biochemistry lab.

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)										
	PO 1	PO 2	P O3	PO 4	PO 5	P O6	PO 7	PO 8	P O9	PO 10	PO 11	PO 12
CO1	M			M						S		
CO2	S	M		S	M		M		M			M
CO3	S	M	M	S			M		M			
CO4	M	S	M	M	M		S					

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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Course Content

1. Isolation of industrially important microbes
2. Production of enzymes by SmF / SSF using industrial / agriculture residues
3. Enzyme assay - α-Galactosidase / Papain / Amylase / xylanase / cellulase
4. Partial purification of enzymes by acetone precipitation / Ultra-filtration
5. Enzyme kinetics – Michaelis-Menten parameters
6. Enzyme inhibition kinetics
7. Effect of temperature and pH on enzyme activity
8. Enzyme immobilization – Gel entrapment / cross-linking
9. Hydrolysis of raffinose and stachyose by immobilized α-galactosidase
10. Degradation of recalcitrant dyes with immobilized enzymes / cells
11. Introduction to fermenters (case study)

Practical: 45 Hours **Total Hours : 45**

REFERENCES:

1 Sadasivam S and Manickam A., "Biochemical methods", 3rd Edition, New Age International Publisher, 2008.

2 Ninfa AJ and Ballou DP, "Fundamental lab. approaches for biochemistry and biotechnology", 2nd Edition, Oxford University Press, UK, 1998.

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U14BTP503	GENETIC ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Objective(s):

- To gain hands on experience in amplify a gene
- To acquire skill preparing recombinant DNA molecule
- To perform DNA fingerprinting using RAPD

Course Outcomes :

CO1 : Design primers for PCR and analyse PCR product

CO2 : Construct and analyse a recombinant DNA from cloned DNA fragment

CO3 : Analyse recombinant proteins

CO4 : Apply PCR for disease diagnosis

CO5 : Execute DNA fingerprinting technique to construct phylogenetic tree

Pre-requisite:

1 U14BTP403 Cell and Molecular Biology Lab

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	W	M		W							
CO2	S	W							S			
CO3	S		W	M					S			
CO4					S							
CO5				M								

Course Assessment methods:

Direct		Indirect	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

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Course Content

1. PCR amplification of DNA fragment using gene (GFP gene)specific primers
2. Elution of DNA from agarose gel using silica column and calculation of Insert-vector ratio.
3. Ligation of a PCR product in T-vector
4. Preparation and Transformation of competent cells (BL21 (DE3) *E.coli* by heat-shock method
5. Selection of recombinant clones using blue & white selection
6. Confirmation of presence of insert in the recombinant clones by colony PCR
7. Optimization of inducer concentration for recombinant protein production
8. Recombinant protein purification and analysis in SDS-PAGE
9. Confirmation of recombinant protein using Western blotting
10. DNA fingerprinting by RAPD analysis (Bacteria)
11. Molecular diagnosis of viral/bacterial pathogen using PCR

Practical: 45 Hours **Total Hours : 45**

REFERENCES:

1 Green and Sambrook, *Molecular Cloning A laboratory Manual* (3 volumes), CSHL Press, NY, 2012.

OTHER REFERENCES:

1 Sambrook et al., *Molecular Cloning: A Laboratory Manual* (3 Volumes) 3rd ed. Cold Spring Harbor Laboratory press, Cold Spring Harbor, NY, 2001.

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U14BTP504 IMMUNOLOGY LABORATORY

L	T	P	C
0	0	3	3

Objectives:

- To develop skills of students in Immunological techniques by performing simple experiments in the laboratory
- To perform techniques like blood grouping, ELISA, & identification of T-cell
- To study the applications of immunotechniques.

Course Outcomes :

CO1 : Learn to handle animals and prepare antigens.
CO2 : Identify blood cells and its components.
CO3 : Understand and apply Immunological techniques.
CO4 : Perform Immuno assay tests.
CO5 : Speration and identification immunological cells.

Pre-requisite:

1 U14BTP403 Cell and Molecular Biology Lab

CO/PO Mapping
(S-Strong, M-Medium, W-Weak)

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1			M					S	M			
CO2				W					M			
CO3		M			S				M			
CO4									M			
CO5			S						M			

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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Course Content

1. Selection of animals, Preparation of antigens, immunization and method of bleeding, Serum separation and storage
2. Blood smear identification of leucocytes by Giemsa stain
3. Ouchterlony Double Diffusion Test
4. Single radial diffusion test
5. Immunoelectrophoresis
6. Rocket Electrophoresis
7. Testing for typhoid antigens by Widal test
8. Identification of blood group
9. Separation of leucocytes by dextran method
10. Separation of mononuclear cells by Ficoll-Hypaque
11. Enzyme Linked Immuno Sorbent Assay (ELISA)

Theory: Nil **Practical: 45hrs** **Total Hours : 45**

REFERENCES:

1 Hudson L. and Hay H. C (2008) *Practical Immunology*. Blackwell Scientific Publications.

2 Frank C. Hay, Olwyn M. R. Westwood, Paul N. Nelson and Leslie Hudson W (2006) *Practical Immunology*, Wiley-Blackwell Publications.

OTHER REFERENCES:

1 https://sites.google.com/site/hoaisclassroom/classroom-news/labmanual-immunology

2 http://www.nvcc.edu/manassas/biotech/Immunology_Manual.pdf

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SEMESTER VI

U14BTT601	BIOPROCESS CONTROL AND AUTOMATION	L	T	P	C
		3	0	0	3

Objective:

- To make the students understand the applications of process control in bioprocess engineering

Course Outcomes :

CO1 : The students would understand basic principles of process control system.

CO2 : The students would understand controllers and control elements in process control.

CO3 : The students would design control system for bioreactors.

CO4 : The students would apply knowledge on control system in bioprocess industries.

CO5 : The students would apply knowledge on control system in bioreactors.

Pre-requisite:

1 U14BTT304 Biochemical Process Calculations

2 U14BTT403 Fluid and Particle Mechanics in Bioprocesses

3 U14BTT504 Heat and Mass Transfer in Bioprocesses

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

LINEAR OPEN LOOP SYSTEMS 9 Hours

Laplace transform, Response of First-Order Systems, Physical Examples of First-Order Systems, Response of First-Order Systems in Series, Higher-Order Systems: Second-Order and transportation lag

LINEAR CLOSED-LOOP SYSTEMS 9 Hours

The Control System, Controllers and Final Control Elements, Block Diagram of a Reactor Control System, Closed-Loop Transfer Functions, Transient Response of Simple Control Systems, Stability, Root Locus

FREQUENCY RESPONSE 9 Hours

Introduction to Frequency Response, Control System Design by Frequency Response

PROCESS APPLICATIONS 9 Hours

Advanced Control Strategies, Controller Tuning and Process Identification, Control Valves, Theoretical Analysis of Complex Processes

BIOPROCESS CONTROL 9 Hours

Basic configuration of bioreactors and their ancillaries, Online estimation and monitoring of pH, temperature, dissolved oxygen and liquid level in bioreactors, Stability analysis of bioreactors, Overview of piping and instrumentation diagram, distributed control system, programmable logic controllers and building automation system in bioreactors.

Theory: 45hours Total Hours :45

REFERENCES:

1 Coughanour, D.R., "*Process Systems analysis and Control*", McGraw Hill.1991

2 Stephanopoulous, G., Chemical Process Control: *An Introduction to Theory and Practice*, Prentice Hall of India 1984

3 Harriott, P., *Process Control*, Tata McGraw Hill.1972.

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OTHER REFERENCES:

1 K. Krishnaswamy, “*Process Control”* New Age International. 2007

2 C.D. Johnson, “*Process control instrumentation technology*” Eastern Economy Edition, 2012

4 https://noppa.aalto.fi/noppa/kurssi/as-84.3165/materiaali/AS-84_3165_part_5_-_alford___advances_and_challenges_2.pdf

5 http://www.eolss.net/sample-chapters/c17/E6-58-02-01.pdf

U14BTT602	PROTEIN STRUCTURE AND ENGINEERING	L	T	P	C
		3	0	0	3

Objectives:

- To learn the various topologies of supersecondary, tertiary and quaternary structures
- To understand the relationship between protein structure and function using some models
- To learn the fundamentals of protein engineering and design

Course Outcomes :

CO1 : Explain and analyze the secondary and supersecondary structural features

CO2 : Discuss and distinguish the tertiary structure with quaternary structure of proteins

CO3 : Demonstrate the protein – non-protein interactions

CO4 : Understand the basics and steps involved in protein engineering

CO5 : Describe the protein engineering design to construct various proteins

Pre-requisite:

1 U14CHT101 Engineering Chemistry

2 U14BTT201 Biomolecules and Genetics

3 U14BTT501 Genetic Engineering

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S		M	M	M							S
CO2	S	M	M	S	W							S
CO3	S	S	M	S								S
CO4	S	M		M	W							M
CO5	M	S	W	S	W							M

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

SECONDARY AND SUPER SECONDARY STRUCTURES 9 Hours

Primary strucuture - Insulin; Secondary structures- Alpha (keratin), beta (silk fibroin) and loop structures, Structure of collagen; Super secondary structures - Helix-turn-helix, hairpin β motif, Greek key motif, Beta-alpha-beta motif and topology diagrams; Ramachandran plot.

TERTIARY AND QUATERNARY STRUCTURES 9 Hours

Tertiary structure – types of different domains (α, β and α / β); α domain – Coiled to coil structure and Four helix bundle; β domain – up and down, Greek key and jelly roll barrels; α / β domains – TIM barrel, glycolate oxidase, methyl malonyl CoA mutase, Rossman fold and Horseshoe fold; Protein folding – role of molecular chaperones, protein disulphide isomerase and peptidyl prolyl cis-trans isomerase; Quaternary structure- Modular nature and formation of complexes.

PROTEIN STRUCTURE-FUNCTION RELATIONSHIP 9 Hours

DNA-binding proteins- Prokaryotic transcription factors, helix-turn-helix motif of Trp- repressor & Cro protein in DNA binding; Eukaryotic transcription factors- TATA box-binding proteins, TFIIA and TFIIB; Homeodomain; Zn-fingers; Membrane Proteins: General characteristics, K-Channel, Bacteriorhodopsin, and Photosynthetic reaction center.

FUNDAMENTALS OF PROTEIN ENGINEERING 9 Hours

Introduction; Strategies for protein engineering – rational and *de novo* design; strategies to improve the protein stability; Site directed mutagenesis - M13, plasmid DNA, error prone PCR, nucleotide analogs, phage display and DNA shuffling; Solvent engineering - Lipase.

PROTEIN ENGINEERING DESIGN **9 Hours**

Protein engineering design - Thermal stability of T4-lysozyme, prevention of insulin aggregation, Ras proteins and pertussis and E. coli heat labile toxin; *In silico* engineering of proteins; Abzymes; Enzymes - Understanding catalytic design by engineering alcohol dehydrogenase and β-glycoside hydrolases; Streptavidin & STREP-tag for affinity purification; Antibody engineering - introduction and production of recombinant bispecific antibodies

Case study: Design and expression of heterologous protein (insulin) in *Pichia pastoris*

Theory: 45 Hours **Total Hours : 45**

REFERENCES:

1 Branden C and Tooze J. (1999) *Introduction to Protein structure*, 2nd Edition, Garland Publishing. NY, USA.

2 Voet D., Voet G. (2010) *Biochemistry*, 4th edition, John Wiley & Sons.

3 Alan Fersht. (1999) *Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding*. 3rd revised edition, W.H.Freeman & Co Ltd.,

4 Pravin Kaumaya**.** (2012) *Protein Engineering*, 1st Edition, InTech Publishers, Open Access Book.

5 Moody P.C.E. and Wilkinson AJ. (1990) *Protein Engineering*, 2nd Edition, IRL press, Oxford, UK.

6 Creighton T.E. (1992) *Proteins: Structure and Molecular Properties*, 2nd Edition, Freeman, WH.

7 Creighton T.E. (1997) *Protein Structure: A Practical Approach*, 2nd Edition, Oxford University Press.

8 Lilia Alberghina. (2003) *Protein Engineering in Industrial Biotechnology*, CRC press, Harwood Academic Publishers,

9 Schulz, G.E.and Schirmer, RH. (2003) *Principles of protein structure*, 3rd edition, Springer.

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OTHER REFERENCES:

1 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2763986/

2 www.niscair.res.in/sciencecommunication/ResearchJournals/rejour/ijbt/ijbt2k6/ijbt_july06.asp

3 http://books.google.co.in/books?id=x0UyTLIhWSAC&pg=PA227&source=gbs_toc_r&cad=3#v=onepage&q&f=false

4. http://books.google.co.in/books/about/Antibody_Engineering.html?id=x0UyTLIhWSAC

U14BTT603	BIOPHARMACEUTICAL TECHNOLOGY	L	T	P	C
		3	0	0	3

Objective:

- To understand the importants of drug control, standard and manufacture process

Course Outcomes :

CO1 : Outline drug standards and pharmacopoeia commission

CO2 : Describe the principles of drug action and mechanism of action

CO3 : Discuss and obtain knowledge on the drug development and manufacture process

CO4 : Explain the principles and materials involved during the drug manufacture in pharmaceutical industries

CO5 : Discuss the clinical uses of biopharmaceutical therapeutics

Pre-requisite:

1 U14BTT302 Microbiology

2 U14BTT505 Immunology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S		M		M							
CO2	M		M									
CO3	M		S		M							
CO4			M									
CO5	M	S		S								

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

OVERVIEW OF PHARMACEUTICALS — 9 Hours

Introduction to drugs and pharmacy: History of pharmacy & pharmaceutical industry, age of biopharmaceutical, drug standards (United States Pharmacopeia & Indian Pharmacopeia), Drug regulation and control- Food and Drug Administration (FDA), New Drug Application (NDA), Indian Pharmacopoeia commission (IPC).

PHARMACOKINETICS AND PRINCIPLES OF DRUG ACTION — 9 Hours

Route of drug administration - Enteral and parenteral, Pharmacokinetics - Drug Absorption, Distribution, Metabolism and Elimination (ADME); factors influencing ADME process; Pharmacodynamics – basic principles of drug action, Mechanism of drug action, through enzymes, drug receptor interactions; radiopharmaceutical.

DRUG DEVELOPMENT AND MANUFACTURE PROCESS — 9 Hours

New Drug development: Drug discovery, patenting, preclinical and clinical trials, and regulatory authorities; Manufacturing process: special manufacturing facilities, sources of biopharmaceuticals, production of final product and analysis of the final product. Good Manufacturing Practice (GMP).

PRINCIPLES OF DRUG MANUFACTURE IN PHARMACEUTICALS — 9 Hours

Dosage form design: Need for dosage forms, General considerations in Dosage form design; Solid dosage forms – powders, granules, capsules and tablets; Semisolid dosage forms – ointments, creams and gels; transdermal drug delivery system; Pharmaceutical inserts – suppositories and inserts; Liquid dosage forms – solutions; Sterile dosage forms – parenteral (injections), Biologics (vaccine).

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BIOPHARMACEUTICAL THERAPEUTICS AND CLINICAL USES **9 Hours**

Various categories of therapeutics and uses: Cytokines – interferon, interlukins, tumour necrosis factor. Heamopoietic growth factors – Colony stimulating factor (granulocyte, macrophage), erythropoietin. Hormones – insulin, glucagons .

Theory:45 Hours **Total Hours :45**

REFERENCES:

1 Harvey, R.A., Clark, M.A., Finkle, R., (2011), *Pharmacology* (Lippincott Illustrated Reviews Series, LWW Publishers, 5th Ed.,

2 Katzung, B., Masters, S., Trevor, A., (2009), *Basic and Clinical Pharmacology* (LANGE Basic Science), McGraw-Hill Medical, 11th ed.,

3 Ansel H.C., et al. (2007) *Pharmaceutical dosage forms and drug delivery systems*- 8th edition, Lippincott Williams & Wilkins.

4 Richard D. Howland. (2007) *Lippincott's illustrated reviews: Pharmacology*. 7th Edition, Lippincott Williams & Wilkins.

5 Remington (2000) *Pharmaceutical sciences*, 20th edition, Mack publishing and Co., PA

6 Troy, D. B (2006) *Remington: the Science and practice of Pharmacy*, 21st edition. Vol I & II., Lippincott Williams & wilkins., New york.

5 Gary Walsh. (2005) *Biopharmaceutical technology-biochemistry and biotechnology*, 1st Edition, John Wiley and Sons, Ltd.

OTHER REFERENCES

1 http://ocw.mit.edu/courses/health-sciences-and-technology/hst-151-principles-of-pharmacology-spring-2005/lecture-notes/

2 www.mccc.edu/~behrensb/documents/.../2011Pharmacologywk1.pdf

3 http://watcut.uwaterloo.ca/webnotes/Pharmacology/

U14BTT604	BIOREACTOR ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

Objective:

- To enable the students understand the bioreactor analysis and design

Course Outcomes :

CO1 : The students would remember and understand the basic principles of reaction mechanism and kinetics.

CO2 : The students would apply non-ideal systems in bioreactors

CO3 : The students would design single bioreactors for submerged fermentation

CO4 : The students would design multiple bioreactors for submerged fermentation

CO5 : The students would design bioreactors from mechanical aspects

Pre-requisite:

1 U14BTT304 Biochemical Process Calculations

2 U14BTT403 Fluid And Particle Mechanics in Bioprocesses

3 U14BTT504 Heat And Mass Transfer in Bioprocesses

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P O9	PO 10	PO 11	PO 12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

REACTION KINETICS IN REACTORS **9 Hours**

Search for enzymatic and microbial reaction mechanism, Methods of analyzing batch reactor data - Integral and differential, Analysis of total pressure data obtained in constant and variable volume system; Performance equations of ideal batch, plug and mixed flow reactors, Space time and Space velocity.

IDEAL AND NON-IDEAL REACTORS **9 Hours**

Size comparison of single and multiple reactor systems, Reactors for autocatalytic reactions, recycle reactors, ills of bioreactors, RTD- E and F in bioreactor design, Models for Non ideal flow, Applications of RTD based models to Non ideal reactors.

BIOREACTOR DESIGN FOR SUBMERGED FERMENTATION **9 Hours**

Batch bioreactor, Continuous flow stirred tank bioreactor, Plug flow tubular bioreactor and Recycle reactor

BIOREACTOR DESIGN FOR ENZYME REACTION AND IMMOBILISED CELLS **9 Hours**

Multistage and semicontinuous bioreactors, Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions, formulation of dimensionless groups and calculation of effectiveness factors, Design of immobilized packed bed, fluidized bed and membrane reactors.

MECHANICAL ASPECTS OF BIOREACTOR DESIGN **9 Hours**

Guidelines for bioreactor design, bioreactor vessels, bioreactor assembly

Theory:45 Hours **Total Hours :45**

REFERENCES:

1 Tapobrata panda, "*Bioreactors Analysis and Design*", New Delhi: Tata McGraw Hill.2011.

2 Levenspiel, Octave, "*Chemical Reaction Engineering*", 3rd Edition,

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Hoboken/New Jersey: John Wiley & Sons. 1999.

3 Fogler, H.S., "*Elements of Chemical Reaction Engineering*", 2nd Edition, New Delhi: Prentice Hall of India. 1999.

4 Richardson, J.E., D.G. Peacock, *"Coulson & Richardson Chemical Engineering*", Vol.3,3rd Edition, United Kingdom: Butterworth – Heinemann/ Elsevier.

5 Shuler M.L. and Kargi F.,"*Bioprocess Engineering: Basic Concepts*", 2nd Edition, New Delhi, Prentice-Hall of India. 2012.

OTHER REFERENCES:

1 Nauman, E. Bruce, "Chemical Reactor Design, Optimization, and Scale up", New Delhi: Tata McGraw Hill. 2002

2 www.academia.edu/5278317/Bioreactors_Design_and_Analysis

3 oaji.net/articles/2014/215-1402978704.pdf

4 http://nptel.ac.in/syllabus/syllabus.php?subjectId=103107079

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U14BTT605	**FOOD BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Objective:

- To learn about food and nutrients
- To understand the role of functional foods
- To know the strategies to produce specific food ingredients

Course Outcomes :

CO1 : Describe about food and nutrients.
CO2 : Explain the expanding role of functional foods and nutraceuticals in the promotion of human health and nutrition.
CO3 : Perceive the advantages and disadvantages of probiotics and prebiotics.
CO4 : Enable students to modify foods using biotechnology.
CO5 : Learn the strategies to produce specific food ingredients.

Pre-requisite:

1 U14BTT303 Concepts in Industrial Biotechnology
2 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	S		M		S	S						
CO2	S	M	S		S							
CO3	M	M	M	W	S	S						
CO4	S	M	M		S							M
CO5	S	M	S		S							

Course Assessment methods:

Direct		**Indirect**	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

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Course Content

THE RELATIONSHIP BETWEEN FOOD AND HEALTH 9 Hours

Food : definition; five food groups; Nutrition: Balanced diet, Essential amino acids and fatty acids, PER, Water soluble and fat soluble vitamins, Role of minerals in nutrition, Antinutrients, Nutrition deficiency diseases.– Diabetes mellitus, marasmus, Kwashiokar, scurvy, Beri-beri, Rickets.

FUNCTIONAL FOODS AND NUTRACEUTICALS 9 Hours

Functional foods: categories of functional foods, processed foods, GM foods,role of biotechnology in functional foods, Nutrition related diseases and relevant functional foods : Atherosclerosis, cardiovascular disease, cancer, obesity, osteoporosis, Nutraceuticals: definition, major nutraceuticals and their applications, case study on prevention of cancer using phytochemicals.

PROBIOTICS AND PREBIOTICS 9 Hours

Probiotics – definition, potential benefits , strains, advantages and disadvantage, genomics of probiotic lactic acid bacteria : impact on functional foods ; prebiotics: definition, types of new prebiotics and their bifidogenic effects, health effects of prebiotics and synbiotics.

BIOTECHNOLOGICAL APPROACHES TO MODIFY FOOD 9 Hours

Modern biotechnology for the production of dairy products; Modification of poultry and egg : genetic modification of the birds for meat and egg types birds, Bacterial food additives and dietary supplements ; biotechnological modification of *Saccharomyces cerevisiae.* Biotechnological approaches to improve nutritional quality and shelf life of fruits and vegetables.

FOOD SAFETY AND QUALITY CONTROL 9 Hours

Food safety: definition, introduction to food laws in force in India, Objectives, importance and functions of quality control. HACCP, Food and hygiene regulations. GMP and codex in food. International and National food laws. USFDA/ISO-9000 and FSSAI. Food adulteration-detection(demonstration). Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis quality control. Quality control of food at all stages and for packaging materials. Non-destructive food quality evaluation methods.

Theory: 45 Hours **Total Hours :45**

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REFERENCES:

1 Shankuntala Manay N and Shadaksharaswamy M , *Foods : facts and principles* , 3rd edition , New Age International Publishers , India,2009.

2 Sri Lakshmi B , *Food Science*, New Age International Publishers , India,2007

3 Adams, M.R. and Moss M.O., *Food microbiology*, New Age International Publishers, India,2008.

4 Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin,*Food biotechnology*,2nd edition,CRC Press,2006.

5 Bruce J German and Jean-Richard Neeser, *Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals* CRC Press, 2004.

OTHER REFERENCES:

1 Potter N, Food science. CBS publishers & distributors, Delhi,1996.

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L	T	P	C
3	0	0	3

U14GST007 PROFESSIONAL ETHICS

Objectives:

- To create an awareness on Engineering Ethics and its use in ones profession
- To instill moral values, social values and loyalty
- To provide an insight into ones professional rights and a view of professional ethics in the global context

Course Outcomes :

CO1 : Understand the basics of measurements and different extraction methodologies, and their applications in biotechnology

CO2 : Describe the instrumentation and applications of specialized molecular spectroscopic techniques

CO3 : Demonstrate the principles and techniques of chromatography and electroanalytical methods and their applications in biotechnology

CO4 : Explain the various electrophoretic techniques and their applications in biotechnology

CO5 : Understand and interpret the various structural elucidation and radioisotope methods

Pre-requisite:

1 Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S			M		M						M
CO2	S	M	M	S								S
CO3	S	S	M	S								S
CO4	S	S	M	S								S
CO5	S	M	M									

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

ENGINEERING ETHICS AND THEORIES **9 hours**

Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan's theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION **9 hours**

Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

SAFETY **9 hours**

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – the Three Mile Island and Chernobyl case studies. Bhopal gas tragedy.

RESPONSIBILITIES AND RIGHTS OF ENGINEERS **9 hours**

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination.

GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTS AND LEADERS **9 hours**

Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

Theory: 45 Hours **Total Hours :45**

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REFERENCES:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”. (2005) McGraw-Hill, New York.
2. John R. Boatright, “Ethics and the Conduct of Business”, (2003) Pearson Education, New Delhi.
3. Bhaskar S. “Professional Ethics and Human Values”, (2005) Anuradha Agencies, Chennai.
4. Charles D. Fleddermann, “Engineering Ethics”, 2004 (Indian Reprint) Pearson Education / Prentice Hall, New Jersey.
5. Charles E. Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and cases”, 2000 (Indian Reprint now available) Wadsworth Thompson Learning, United States.

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U14BTP601	BIOPROCESS ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Objective(s):

- Provide hands-on training on the operation of fermenters
- To familiarize the students with microbial growth kinetics
- To know mass transfer in fermenters and production of metabolites

Course Outcomes :

CO1 : Analysis of microbial growth in batch, fed-batch and continuous cultivation

CO2 : Analyze and interpret the results of estimation of K_La by different methods

CO3 : Explain medium optimization methods in biotechnology research

CO4 : Demonstrate the production of metabolites

Pre-requisite:

1 UBTP502 Enzyme technology lab.

2 UBTP302 Microbiology lab.

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M			M	M					M		
CO2	S	S	S	S	M				S		S	
CO3	S	S	S	S	M				S			
CO4		S	M				W					

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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Course Content

1. Batch sterilization design
2. Batch cultivation - calculation of μ and product formation rate (Yp/s)
3. Fed-batch cultivation - calculation of μ and product formation rate (Yp/s)
4. Continuous cultivation - calculation of μ and product formation rate (Yp/s)
5. Medium optimization by Plackett-Burman design
6. Estimation of K_La – power correlation method
7. Estimation of K_La – sulfite oxidation method / dynamic gassing method
8. Residence Time Distribution (RTD)
9. Production of microbial metabolites (enzymes / antibiotics) in bioreactors
10. Production of biofertilizers / biopesticides / mushroom
11. Medium optimization by response surface methodology (RSM)

Practical: 45 Hours **Total Hours : 45**

REFERENCES:

1 Sadasivam S and Manickam A., (2008)"*Biochemical methods*", 3rd Edition, New Age International Publisher.

2 Ninfa A.J and Ballou. D.P, (1998) "*Fundamental lab. approaches for biochemistry and biotechnology*", 2nd Edition, Oxford University Press, UK.

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U14BTP602	BIOPROCESS DESIGN AND SIMULATION LABORATORY	L	T	P	C
		0	0	4	2

Objective:

- Provide hands-on training on the operation of fermenters
- To familiarize the students with microbial growth kinetics
- To know mass transfer in fermenters and production of metabolites

Course Outcomes :

CO1 : Provide hands-on training on the operation of fermenters
CO2 : To familiarize the students with microbial growth kinetics
CO3 : To know mass transfer in fermenters and production of metabolites
CO4 : Provide hands-on training on SuperPro Designer

Pre-requisite:

1 UBTP402 Unit Operations Lab

CO/PO Mapping
S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M			M	M					M		
CO2	S	S	S	S	M				S		S	
CO3	S	S	S	S	M				S			
CO4		S	M				W					

Course Assessment methods:

Direct		Indirect	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

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Course Content

1. Introduction to process flowsheeting and simulation
2. Model assisted design and simulation of enzyme production by submerged fermentation (SmF)
3. Model assisted design and simulation of enzyme production by solid state fermentation (SSF)
4. Model assisted design and simulation of biodesiel production from degummed oil
5. Model assisted design and simulation of bioethanol production from corn
6. Model assisted design and simulation of manfacuring Clopidogrel (CPG)
7. Modelling and simulation of FructosylTransferase
8. Modelling and simulation of oil production from algae
9. Modelling and simulation of Human insulin production
10. Modelling and simulation of citric acid production
11. Modelling and simulation of theruputic monoclonal antibody production

Practical: 45 Hours **Total Hours : 45**

REFERENCES:

1 Demetri Petrides, (2003) *SuperPro Designer*, Intelligen Inc.,

2 Roger G.Harrison, Paul Todd, Scott R.Ruger and Demetri P. Petrides, *Bioseparation Science and Engineering*', Oxford University Press, 2nd ed. NewYork, 2009.

OTHER REFRENCES

1 www. biosep.ou.edu

2 www.intelligen.com/literature.html

U14ENP401 COMMUNICATION SKILLS LABORATORY

L	T	P	C
0	0	3	1

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To impart communicative ability to exhibit the individual's subject knowledge
- To achieve the desirable communicative competence by the students to meet the expectation of corporate
- To show the need for a comprehensive link language to share subject expertise
- To offer adequate exposure to soft skills needed for the corporate.
- To sensitize towards corporate culture.

COURSE OUTCOMES

CO1: Imparting the role of communicative ability as one of the softskills needed for placement

CO2: Developing communicative ability and softskills needed for placement

CO3: Making students Industry-Ready through inculcating team-playing capacity

Prerequisite course: U14ENT101 Functional English

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1			S		M					S		
CO2	S	S			S		M			S		
CO3	S	S		S	S				S		M	S

Course Assessment methods:

Direct		Indirect	
1	Model examination	1	Course end survey
2	End semester examination	2	Faculty survey
		3	Industry
		4	Alumni

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GRAMMAR IN COMMUNICATION **9 hours**

Grammar and Usage – Building Blocks, Homonyms, Subject and Verb Agreement, Error Correction - Grammar Application, Framing Questions – Question words, Verbal Questions, Tags, Giving Replies –Types of Sentences, Listening Comprehension –Listening and Ear training.

ASSERTIVE COMMUNICATION **9 hours**

Listening Comprehension in Cross–Cultural Ambience, Telephonic Conversations/Etiquette, Role Play Activities, Dramatizing Situations- Extempore – Idioms and Phrases.

CORPORATE COMMUNICATION **9 hours**

Video Sensitizing, Communicative Courtesy – Interactions – Situational Conversations, Time Management, Stress Management Techniques, Verbal Reasoning, Current Affairs – E Mail Communication / Etiquette.

PUBLIC SPEAKING **9 hours**

Giving Seminars and Presentations, Nuances of Addressing a Gathering - one to one/ one to a few/ one to many, Communication Process, Visual Aids & their Preparation, Accent Neutralization, Analyzing the Audience, Nonverbal Communication.

INTERVIEW & GD TECHNIQUES **9 hours**

Importance of Body Language –Gestures & Postures and Proxemics, Extempore, Facing the Interview Panel, Interview FAQs, Psychometric Tests and Stress Interviews, Introduction to GD, Mock GD Practices.

REFERENCES:

1. Bhatnagar R.P. & Rahul Bhargava, (1989) "*English for Competitive Examinations*", Macmillian Publishers, India, ISBN: 9780333925591.
2. Devadoss K. & Malathy P., (2013) "*Career Skills for Engineers*", National Book Publishers, Chennai.
3. Aggarwal R.S., (2012) "*A Modern Approach to Verbal & Non–Verbal Reasoning*", S.Chand Publishers, India, ISBN : 8121905516**.**

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SEMESTER VII

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U14BTT701	ADVANCED BIOINFORMATICS

L	T	P	C
3	0	0	3

Objective(s):

- To understand the significance of string alignment
- To construct the phylogenetic tree
- To understand the fundamentals of protein structure prediction and microarray analysis

Course Outcomes :

CO1 : Explain various types of network protocols and biological databases

CO2 : Demonstrate and interpret the string matching and dynamic program algorithms of macromolecular strings

CO3 : Apply, solve and interpret the heuristics based pairwise and multiple sequence analysis of macromolecules

CO4 : Construct and interpret the molecular phylogenetic trees

CO5 : Predict and understand the gene and protein structures, and microarrays

Pre-requisite:

1 U14BTT201 Biomolecules and Genetics
2 U14BTT404 Cell and Molecular
3 U14BTT602 Protein structure and Engineering
4 U14BTT603 Biopharmaceutical Technology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M		S	M	W							
CO2	S	S		M	S							M
CO3	S	S	W	S	S							S
CO4	S	M		M	S							W
CO5	S	S	M	M	M							M

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

BIOLOGICAL DATABASES **9 Hours**

Operating systems- types; UNIX commands; Network Protocols – OSI, TCP/IP and ftp; Introduction to databases – Biological databases; Primary nucleotide databases (EMBL, GeneBank and DDBJ); Primary protein databases (SwissProt, TrEMBL and PIR); Composite protein sequence database – OWL and NRDB; Secondary protein databases (PROSITE, BLOCKS and Profiles); Structural databases – SCOP and CATH.

STRING MATCHING AND DYNAMIC PROGRAMMING **9 Hours**

Introduction to strings; substrings; Concepts of identity, similarity and INDEL; Biological significance of gaps and types of gap penalties; Introduction to Naïve and Boyer – Moore algorithm; Algorithm of dot matrix analysis; Introduction to pairwise sequence alignment – local vs. global; Dynamic programming – Needleman –Wunsch algorithm & Smith – Waterman algorithm; Parametric and suboptimal alignments.

DATABASE SEARCH ALGORITHMS **9 Hours**

Substitution matrices – PAM and BLOSUM; Position specific scoring matrices (PSSM); Heuristic methods – Algorithm and applications of FASTA, BLAST and PSI BLAST; Multiple sequence alignment (msa) – Sums of pairs method (SP), CLUSTAL W and PILEUP; Introduction to iterative msa methods; SAGA; Expectation – Maximization (EM) algorithm; Machine learning – Hidden Markov models.

PHYLOGENY ANALYSIS AND GENE PREDICTION 9 Hours

Molecular Clock theory (old and new); Jukes-Cantor and Kimura's model; Distance matrix methods – Unweighted pair group method of arithmetic mean (UPGMA) algorithm, Fitch-Margoliasch algorithm (FM), Neighbor – Joining method (NJ); Character based methods – Maximum parsimony and maximum likelihood; Bootstrapping technique; Prokaryotic and eukaryotic gene prediction methods – Feature and homology based methods.

STRUCTURE PREDICTION OF PROTEINS 9 Hours

Micro array analysis – Spotted and oligonucleotide arrays; Clustering gene expression profiles – Hierarchical clustering, Nearest neighboring clustering and Unweighted pair group clustering; Protein secondary structure prediction – Chow-Fasman method, GOR method, *ab initio* approach and threading method; Systems biology – Introduction to metabolic pathways; Introduction to computer aided drug design (CAD).

Theory: 45 Hrs **Total Hours : 45**

REFERENCES:

1 Bergeron.B. (2009) *Bioinformatics Computing*, 2nd Edition, Prentice Hall of India Learning Pvt (Ltd), India.

2 Attwood, T.K and ParrySmith.D.J. (2002) *Introduction to Bioinformatics*, 1st Edition, Pearson Education Asia, India.

3 Rastogi,S.C, Mendiratta.N and Rastogi.P. (2013) *Bioinformatics – Methods & Applications: Genomics, Proteomics and Drug Discovery*, 4th Edition, Prentice Hall of India Learning Pvt (Ltd), India.

4 David W.Mount. (2004) *Bioinformatics – Sequence & Genome Analysis*, 2nd Edition, Cold Spring Harbor Lab (CHSL) press, USA.

5 Dan Gusfield. (2008) *Algorithms on Strings, Trees and Sequences*, Canbridge University Press, UK. Online publication (2010). (1997), Book DOI: http://dx.doi.org/10.1017/CBO9780511574931

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OTHER REFERENCES:

1 http://mally.stanford.edu/~sr/computing/basic-unix.html

2 http://www.avatar.se/molbioinfo2001/seqali-dyn.html

3 http://www.clcbio.com/index.php?id=1046

4 http://www.ncbi.nlm.nih.gov/About/primer/phylo.html.

5 http://www.ncbi.nlm.nih.gov/Education/BLASTinfo/BLAST_algorithm.html

6 http://nptel.ac.in/courses.php

7 http://nptel.ac.in/downloads/102103044/

U14BTT702 DOWNSTREAM PROCESSING

L	T	P	C
3	0	0	3

Objective:

- To provide an insightful overview of the fundamentals of downstream processing for biochemical product recovery

Course Outcomes :

CO1 : Understanding of different stages of downstream processing

CO2 : Illustrate the solid-liquid unit operation involved in downstream processing

CO3 : Knowledge of principles and working of different unit operations for the isolation and extraction of bio-products

CO4 : Describe the various methods of chromatography used in protein purification

CO5 : Knowledge of different methods and industrial equipments used for the concentration, purification and final polishing of bio-products at the industrial level

Pre-requisite:

1 U14BTT503 Principles of Bioprocess Engineering

2 U14BTT504 Heat and Mass Transfer in Bioprocesses

3 U14BTT502 Enzyme Technology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M		M	M		W		W			M
CO2	S	M		M	M		W		W			M
CO3	S	M		M	M		W		W			M
CO4	S	M		M	M		W		W			M
CO5	S	M		M	M		W		W			M

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

Introduction to Downstream Processing and primary separation **9 Hours**

Introduction to Downstream processing principles, Characteristics of Biomolecules and bioprocesses. Cell disruption methods for intracellular products release: Mechanical methods, Chemical and Enzymatic methods. Unit operations for solid-liquid separation-Filtration (General theory for filtration, Types of equipments, batch-continuous, pretreatment methods) and Centrifugation (General theory for Centrifugation, Types of centrifuges, Scale-up of centrifugation, centrifugal filtration)

ENRICHMENT OPERATIONS **9 Hours**

Adsorption, Extractive separation: Solvent extraction, Aqueous Two Phase and Three Phase Extractions, Riverse Micelle Extraction, Super Critical Extraction. Precipitation methods: Salts, Organic solvents and polymers, Membrane Based Separation: Ultrafiltration, Reverse Osmosis, Dialysis and Electrodialysis

PRODUCT PURIFICATION **9 Hours**

Chromatographic Principles: Distribution coefficients, retention parameters, qualitative and quantitative aspects of chromatography-Column Efficiency, Selectivity and Resolution. Size exclusion Chromatography, Ion exchange chromatography, Reverse phase chromatography, hydrophobic interaction chromatography (HIC), RP - HPLC Affinity chromatography, isoelectric focusing and its applications.

PRODUCT POLISHING **9 Hours**

Crystallization: Methods of super saturation, types of nucleation and crystal growth, Material and energy balance, yield of crystal, Types of crystallization and equipments. Drying: types of moistures, batch drying process, mechanism of drying, drying time calculation, drying equipments

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ANALYSIS OF THE FINAL PRODUCT FORMULATION **5 Hours**

Analysis of the final product - Protein-based contaminants, Removal of altered forms of the protein of interest from the product stream, Product potency, Detection of protein-based product impurities: High-pressure liquid chromatography (HPLC), Mass spectrometry, Immunological approaches to detection of contaminants, Amino acid analysis, Peptide mapping, N-terminal sequencing, Analysis of secondary and tertiary structure, Endotoxin and other pyrogenic contaminants, Endotoxin - the molecule, Pyrogen detection, DNA, Microbial and viral contaminants, Viral assays, Miscellaneous contaminants, Validation studies.

ANALYSIS OF THE FINAL PRODUCT FORMULATION **4 Hours**

Some influences that can alter the biological activity of proteins: Proteolytic degradation and alteration of sugar side-chains, Protein deamidation, Oxidation and disulfide exchange, Stabilizing excipients used in final product formulations, Final product fill , Freeze-drying, labelling and packing.

Theory:45 Hours **Total Hours :45**

REFERENCES:

1 BIOTOL (1995) *Series-Product recovery in Bioprocess Technolog*y, VCH publications.

2 Belter P.A, Cussler,E.L and Wei-Houhu, (1988) *Bioseparations-Downstream Processing for Biotechnology*, Wiley Interscience Publications, USA.

3 Roger G.Harrison, Paul Todd, Scott R.Ruger and Demetri P. Petrides, (2009) "*Bioseparation Science and Engineering*', oxford University Press, 2nd ed. NewYork.

4 Sivashankar, B , (2005) *Bioseparation : Principles and Techniques*' Prentice Hall of India, New Delhi.

5 Jansons. J.C and Ryden L. (Ed), (1989) *Protein purification-Principles, High Resolution Methods and Application*'. VCH Publications.

6 Walsh, Gary. (2007) *Pharmaceutical biotechnology: concepts and applications*. John Wiley & Sons.

OTHER REFERENCES:

1 Scopes, R.K, Protein Purification – Principles and Practice, 2^{nd} ed. Narosa Publications, 2005

2 Frokjaer, S. and Otzen, D. Protein drug stability: a formulation challenge. Nature Reviews Drug Discovery 4, 298–306, 2005.

3. http://nptel.ac.in/courses/102106022/

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U14BTT703	REGULATORY, QUALITY ASSURANCE AND GMP PRACTICES IN BIOMANUFACTURING	L	T	P	C
		3	0	0	3

Objective:

- Student will understand the regulatory practices formulated for manufacturing biologicals

Course Outcomes :

CO1 : Understand the regulatory processes and bodies
CO2 : Describe good laboratory proactices
CO3 : Explain quality assurance
CO4 : Understand concepts of monitoring quality control
CO5 : Describe validation principles as applied to biomanufacturing

Pre-requisite:

1 U14BTT603 Biophrmaceutical Technology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1												
CO2	S	S	W		M							
CO3		M										
CO4		M			S							
CO5		S			M	W						

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

REGULATORY BODIES 9 Hours

National Regulatory requirements: National Drug Policy, Drugs and Cosmetics Act and its amendments, overview of schedules, detail study of schedule M and Schedule Y. International regulation: USFDA, FDA guidelines on IND, NDA and ANDA approvals, and SUPAC changes and understanding on 505 (b) (2) applications

GOOD LABORATORY PRACTIVES 9 Hours

Requirement of GLP Guidance and recommendation on Dissolution and Bio-equivalence requirement. Types of ANDA filing (Para I, II, III, IV filing). Exclusivities (NCE, NS, NP, NDF, PED, ODE, PC) ICH objectives and Guidelines- stability testing, WHO guidelines, ISOs- Production design, certification. ICH 8(QbD), ICH Q9 and ICHQ10

QUALITY ASSURANCE PROCESS 9 Hours

Concepts of Quality Assurance, Total Quality Management, Philosophy of GMP and cGMP Preparation of audit, Conducting audit, Audit Analysis, Audit Report and Audit follow up

QUALITY CONTROL IN BIOMANUFACTURING 9 Hours

Organization and personnel, responsibilities, training hygiene, Premises: Location, design, plan Layout, construction, maintenance and sanitations, environmental control, sterile areas, control of contamination. Equipments: Selection, purchase specifications, maintenance, clean in place (CIP), sterilize in place (SIP), Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls and raw materials, Packaging and labeling controls, line clearance and other packaging materials

MONITORING QUALITY CONTROL 9 Hours

Quality Control Laboratory: Responsibilities, good laboratory practices, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage. Manufacturing documents, Master Formula, Batch Formula, Records, Standard Operating Procedures, In process quality control on various dosage forms sterile and biological

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products, standard operating procedures for various operations like cleaning, filling drying, compression, coating, disinfection, sterilization, membrane filtration, Guidelines for Quality Assurance of Human Blood Products and large volume parenterals

CONCEPTS OF VALIDATION **9 Hours**

Types of validation, Master plan, protocol for process validation, cleaning validation, validation of air handling, validation of equipment and facilities in sterile and non-sterile areas. Prevalidation activities, Protocol preparation, Protocol execution, Deviations and change controls, summary and certification. Revalidation

Theory: 45 Hours **Total Hours : 45**

REFERENCES:

1 D.H. Shah, *Quality Assurance Manual*

2 D.H. Shah, *SOP Guidelines*

3 Graham Bunn and Joseph, (2006)*Good Manufacturing-Practices for Pharmaceuticals*, 6thEd. D.Nally.

4 C.V.S.Subramanyam, *Drug regulatory affairs*

5 Manohar A.Potdar, *Current good manufacturing practices for pharmaceuticals*

6 S.H. Wiling , *Good Manufacturing Practices for Pharmaceuticals*, Vol. 78, Marcel Decker

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U14BTT704	INDUSTRIAL BIOSAFETY AND BIOETHICS	L	T	P	C
		3	0	0	3

Objectives:

- To provide knowledge on various aspects of Industrial biosafety
- To learn procedures and guidelines for biosafety
- To learn concepts of bioethics

Course Outcomes :

CO1 : Students able to understand risks and different accicents at industrial level.

CO2 : Students should understand types of level of biosafety.

CO3 : Students should learn FDA and biosafety guidelines.

CO4 : Students can able to learn GMO's and its regulation in environmental release

CO5 : Students should understand ethical issues and its guideline.

Pre-requisite:

1. U14BTT302 Microbiology;
2. U14BTT501 Genetic engineering;
3. U14BTT603 Biopharmaceutical technology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	S	W		M							
CO3		M			S	W						
CO4		M	W		S							
CO5		S			M	W						M

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

INDUSTRIAL BIOSAFETY **9 Hours**

Introduction to Biosafety; Causes- classification, identification of hazards; issues handling; aware of accidents at industrial level; types of accidents; first aid, precautionary measure.Clean room procedures- Classification specification; Personal protective equipments working with biohazards; Proper gowering and hygiene for clean room work; Behavioral requirements in a controlled environment. Basic methods for safe handling, transport, and storage of biological and chemical materials; Equipment related hazards; safe laboratory techniques; Contingency plan and emergency procedures.

LEVELS OF BIOSAFETY **9 Hours**

Introduction to Biological safety cabinets; Horizontal & *Vertical Laminar Air Flow Cabine*; Fume hood; Primary and secondary containments; Biosafety levels of specific Microorganisms (food and water borne pathogens), Infectious Agents (Chemicals and carcinogens); MSDS- Material Safety Data Sheet- Understanding, and infected animals (test animals).

FDA AND FPO BIOSAFETY GUIDELINES **9 Hours**

FDA guideline and approval; FPO specification and guidelines for food products; GOI - Biosafety procedure, time frames and specification for Production and manufacturing industries- **Case study.**

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INTRODUCTION TO BIOETHICS **9 Hours**

Definition of bioethics; Environmental release of GMOs- Risk analysis, Risk

assessment, Risk management and Communication; Precaution before and after environmental release of GMO's – **case study.**

REGULATORY AFFAIRS **9 Hours**

Overview of national regulation and international agreement on GMO; Cartagena protocol- articles; Ethical committee- administration channel; Role of NIH, IACUC,IBSC

Theory: 44 Hours **Case study: 1 Hour** **Total Hours : 45**

REFERENCES:

1 Deepa Goel and Ms Shomini Parashar , (2013) IPR, *Biosafety and Bioethics*, Pearson Education publisher.

2 Shaleesha A. Stanley (2007) '*Bioethics' Wisdom educational service*, Chennai.

3 Erbisch,F H and Maredia,K M, (1998) *Intellectual property rights in agricultural biotechnology* Universities Press (India) Ltd.

4 Singh. K, (2010)"*Intellectual Property Rights in Biotechnology*" BCLI, New Delhi.

5 Rajiv Jain and Rakhee Biswas, (1999) *Law Of Patents*, *Procedure & Practice*,Vidhi Publication,.

OTHER REFERENCES:

1 https://cgspace.cgiar.org/bitstream/handle/10568/832/ILRI%20Intellectual%20Property%20Policy.pdf?sequence=1

2 http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html

U14BTT705	BIOLOGICAL DATA ANALYSIS AND SCIENTIFIC WRITING	L	T	P	C
		3	0	0	3

Objective:

- To teach the basic concepts of statistics with biological problems and introduce the significance of research

Course Outcomes :

CO1 : Understand the impact and significance of research
CO2 : Interpret the various methods of data collection
CO3 : Solve and interpret the biological problems using simple statistics
CO4 : Formulate and test the hypothesis of biological oriented problems
CO5 : Write a structured report

Pre-requisite:

1 U14MAT305 Probability and Applied Statistics

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
CO1	S			M						S		
CO2	S			S	S					S		S
CO3	S			S	S					S		S
CO4	S			S	S					S		S
CO5	S				S					S		S

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

OVERVIEW OF RESEARCH **9 Hours**

Objectives of research; Motivation in research; Types of research; Significance of research; Criteria of good research; Defining the research problem; Research design – need and basic principles;

METHODS OF DATA COLLECTION **9 Hours**

Collection of primary data - observation and interview method; Collection of data through questionnaires; ; Collection of data through schedules; Other methods of data collection – warranty cards, pantry audits, consumer panel, use of mechanical devices, depth interviews and projective techniques; Collection of secondary data ; Characteristics of secondary data; Significance of case study.

BIOSTATISTCAL ANALYSIS **9 Hours**

Arithmetic mean; Standard deviation; Coefficient of variation; standard error of mean; Correlation analysis; Regression analysis. **[PROBLEMS ALONE SHOULD BE SOLVED]**

HYPOTHESIS TESTING **9 Hours**

Introduction; General concepts; Characteristics; Type I and II errors; Student's t-Test; Chi square test; One way ANOVA; Multiple comparison post hoc tests; Two way ANOVA**. [PROBLEMS ALONE SHOULD BE SOLVED].**

WRITING A RESEARCH REPORT **9 Hours**

Introduction; Types of report – Survey based and algorithmic report; Report format; Bibliography.

Theory:45 Hours **Total Hours : 45**

REFERENCES:

1 R. Panneerselvam. (2006) *Research Methodology*. 1st edition, 3rd reprint, Prentice Hall of India. (Google books)

2 C. R. Kothari. (2004) *Research Methodology: Methods & Techniques*, 2nd Edition, New Age International (P) Ltd., Publishers, (Google books)

3 Bernard Rosner. (2011) *Fundamen tals of Biostatistics*. 7th Edition, Brooks/ Cole, Cengage Learning. (Google books)

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U14BTP701	BIONFORMATICS LABORATORY	L	T	P	C
		0	0	4	2

Objective(s):

- To understand, perform and interpret the pairwise sequence & multiple sequence alignment analysis
- To acquire skill in the construction of phylogenetic trees and to learn the basics of gene prediction methods
- To perform and gain experience in microarray analysis & docking techniques

Course Outcomes :

CO1 **:** Retrieve, align and interpret the macromolecular sequences (pairwise & multiple) using various methods

CO2 **:** Construct the molecular phylogenetic tree and correlate the similarity

CO3 **:** Predict gene and microarray analysis

CO4 **:** Write simple programs and carry out ligand-protein docking

Pre-requisite:

1 U14BTT201Biomolecules and Genetics

2 U14BTT201 Advanced Bioinformatics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	S		S	S					M		S
CO2	S	M		M	S					M		M
CO3	S	S	M	S	M					M		M
CO4	S	M	M	M	S					M		S

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Course Assessment methods:

Direct		Indirect	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

Course Content

EXPERIMENTS:

1. Biological Databanks – Retrieval and annotation of macromolecular sequences and structures from the biodatabases
2. String matching and similarity analysis – Dot matrix method and Dynamic programming (EMBOSS)
3. Database search and sequence similarity analysis – FASTA, BLAST and PSI-BLAST
4. Multiple sequence alignment using CLUSTAL W or CLUSTAL OMEGA or MULTALIN
5. Molecular phylogeny analysis using PHYLIP or NCBI tools or EBI tools
6. Protein sequence analysis using ExPAsY
7. Gene prediction - GENSCAN
8. Molecular visualization of protein structure using RASMOL
9. Microarray analysis
10. Protein – ligand docking
11. Sequence analysis using Perl programming

Theory: Nil **Practical: 45 Hours** **Total Hours : 45**

REFERENCES:

1 Mani.K and Vijayaraj.N. (2004) *Bioinformatics a Practical Approach*, Aparna Publications, India.

OTHER REFERENCES:

1 Websites of NCBI, EBI, SWISS INSTITUTE OF BIOINFORMATICS, DDBJ etc.

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U14BTP702	DOWNSTREAM PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

Objective:

- To develop skills of students perform in various purification techniques used in separation of biomolecules

Course Outcomes :

CO1 **:** Understanding of different stages of downstream processing

CO2 **:** Illustrate the solid-liquid unit operation involved in downstream processing

CO3 **:** Knowledge of principles and working of different unit operations for the isolation and extraction of bio-products

CO4 **:** Describe the various methods of chromatography used in protein purification

CO5 **:** Knowledge of different methods and industrial equipments used for the concentration, purification and final polishing of bio-products at the industrial level

Pre-requisite:

1 U14BTP601 Bioprocess Engineering Lab

2 U14BTP602 Bioprocess Designing and Stimulation Lab

CO/PO Mapping)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M		M	M		W		W			M
CO2	S	M		M	M		W		W			M
CO3	S	M		M	M		W		W			M
CO4	S	M		M	M		W		W			M
CO5	S	M		M	M		W		W			M

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Course Assessment methods:

Direct		Indirect	
1	Model examination	**1**	Course end survey
2	End semester examination	**2**	Faculty survey
		3	Industry
		4	Alumni

Course Content

1. Aqueous two phase extraction of biological samples
2. Solid liquid separation by microfiltration
3. Enzyme concentration by ultra filtration
4. Partial purification of enzymes using salt precipitation and cell disruption techniques
5. Purification of recombinant green fluorescent protein
6. Purification of His-tagged protein purification on Ni-Column
7. Purification of lysozoyme using Ion exchange chromatography
8. Protein purification using gel filtration chromatography, shown on SDS-PAGE.
9. Assessing purity of enzyme(s)/protein(s) by SDS-PAGE
10. Purification of recombinant green fluorescent protein
11. Freeze-Drying of Yeast Cultures Lyophilization
12. Protein purification using High performance liquid chromatography (HPLC)
13. Evaluate the performance and drying characteristics of a laboratory scale spray dryer

Theory:Nil **Practical: 45 hrs** **Total Hours :45**

REFERENCES:

1 Roger G. Harrison, Paul W. Todd, Scott R. Rudge and Demetri Petrides, (2002) *Bioseparations Science and Engineering*, Oxford University Press, USA.

2 Robert K.Scopes, (2010) *Protein Purification: Principles and Practice*, IIIrd edition, Springer-verlag New York, USA.

3 Rosenberg, Ian M, (2003) *Protein Analysis and Purification, Bench top techniques*, IInd edition, Springer International, New Delhi, India.

U14BTP704 **PROJECT (PHASE I)**

L	T	P	C
0	0	4	2

Objective:

- To formulate a research problem and collect relevant literature

Course Outcomes :

CO1 **:** Formulate an experimental design to solve biological problems
CO2 **:** Conduct survey of literature
CO3 **:** Scientific Presentation skills

Pre-requisite:

1 All previous courses

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
CO1	S				S			S			S	
CO2	S		S								S	
CO3	S		S							S	S	

Course Assessment methods:

Direct		Indirect	
1	Project Reviews	1	Course end survey
2	Final Project Review (Internal Assessment)	2	Faculty survey
		3	Industry
		4	Alumni

Guidelines

1.Students should do carry out Project (Phase 1) under the guidance of a faculty member of the department

2.Evaluation will be done by an internal panel

SEMESTER-VIII

		L	T	P	C
U14BTP801	**PROJECT (Phase II)**	**0**	**0**	**18**	**6**

Objectives

- To obtain research proficiency in biotechnology

Course Outcomes :

CO1 **:** Formulate an experimental design to solve biolotechnological problems

CO2 **:** Develop skills for independent &team oriented research and process innovation

CO3 **:** Analyze, evaluate, interpret and justify an experimental data

CO4 **:** Write a dissertation report

Prerequisite course: All Core and eletive courses

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S				S			S			S	
CO2	S		S								S	
CO3	S		S							S	S	
CO4			s					S			S	
CO5					s					S	S	

Course Assessment methods:

Direct		Indirect	
1	Project Review	**1**	Course end survey
2	Final Project Review (External)	**2**	Faculty survey
		3	Industry
		4	Alumni

Guidelines

1. Evaluation will be via continuous review followed by an external members panel

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ELECTIVES

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U14BTE101	MOLECULAR PLANT BREEDING	L	T	P	C
		3	0	0	3

Objective(s):

- To learn the fundamentals of plant breeding tools
- To study gene manipulation in plants.
- To learn GM crops and their ethical issues.

Course Outcomes :

CO1 : Outline and learn the basics of plant breeding programs.
CO2 : Distinguish the mitochondrial genome and chloplast genome
CO3 : Outline and learn gene manipulation in plants
CO4 : Apply the techniques for development of Hybrids, screening and selection procedure
CO5 : Understand GM crops and their ethical issues.

Pre-requisite:

1 U14BTT404 Cell and Molecular Biology
2 U14BTT501 Genetic Engineering
3 U14BTT506 Mammalian and plant tissue culture

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	S	W		M							
CO3		M			S	W						
CO4		M	W		S							
CO5		S			M	W						M

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

PLANT GENOME AND ORGANIZATION **9 Hours**

Molecular and classical genetics in modern agriculture; plant genomes- the organization and expression of plant genes concept of genetic selection; Chloroplast and Mitochondria genome- Organization and expression (with exanmples)

CONCEPTS IN PLANT BREEDING **9 Hours**

History- Mendelian principles (trihybrid ratio- 2 variables); concept of Green revolution; conventional practices for plant production; Selective and cross plant breeding programs; Plant breeding rights; classic genetic improvement- **case study**

PLANTS IMPROVEMENT **9 Hours**

Improvement of crop yield and Quality (Molecular markers) screening of recombinants; application in agriculture and food industries; Transgenic plants- Biotic and abiotic stress development with examples- **Case study.**

PLANT BREEDING TECHNIQUES **9 Hours**

Plant breeding tools; concept of Hybrid, cybrid-procedure and establishment; screening and selection of hybrids; concept of Male sterility- CMS,GMS,CGMS; Development of biotic and abiotic stress resistance plants.

GM CROPS AND ETHICAL ISSUES **9 Hours**

Gene manipulation and their impacts (Environmental, cultural, ethical and socio economical issues); Environmental release of GMO's; Role of IBSC (RCGM and GEAC); GM crops- Current status, concern about GM crops; Regulation of GM crops and products- Greener genetic engineering.

Theory:45 Hours **Total Hours :45**

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REFERENCES:

1 Clark DP and Pasternick NJ, Biotechnology: Aademic Cell Updates, Academic Press, Elsevier, 2012.

2 Glick BR and Pasternick JJ Molecular Biotechnology: Principles and Applications of Recombinant DNA, 3rd Edition, ASM press, Eashington, 2003.

3 Brown TA., Genomes 2, 3rd edition Bios Scientific Publishers Ltd, Oxford, 2006.

4 http://nptel.ac.in/courses/102103013/

5 http://www.lsic.ucla.edu/ls3/tutorials/gene_cloning.html

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U14BTE102	CONCEPTS IN FOOD SCIENCE	L	T	P	C
		3	0	0	3

Objective(s):

- To understand the basic nutrients of food
- To learn the effect of cooking on the constituents in food
- To know the process for producing various food products

Course Outcomes :

CO1 : Describe about cereals and pulses and its effect on cooking.
CO2 : Classify fruits and vegetables and their composition
CO3 : Perceive the advantages of egg,poultry and meat.
CO4 : Understand about milk, milk products and fats
CO5 : Learn about sugar cookery , beverages and spices.

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry
2 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S		M		S	S						
CO2	S	M	S		S							
CO3	M	M	M	W	S	S						
CO4	S	M	M		S							
CO5	S	M	S		S							

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

CEREALS AND PULSES **9 Hours**

Cereals - Rice & wheat and other Millets - Composition and Nutritive Value.

Starch - Sources, Characteristics, Principles of Starch cookery. Different types of flour, Gluten -properties, Gluten formation. Flour - Types, properties. Bread - yeast leavened, Quick bread, pastries, Role of ingredients & preparation cakes - Role of ingredients &preparation.

Pulses - Composition, types, Cooking methods, factors affecting cooking quality, nutritive value, toxic constituents and its removal, Germination and factors affecting Germination.

VEGETABLES AND FRUITS **9 Hours**

Vegetables - Structure, Classification, Composition, Methods of Cooking, Changes on Cooking - pigments, Nutritive value.

Fruits - Structure, Classification, Composition, Ripening of fruits, changes on ripening, Pectic substances, Cooking changes.

EGG,MEAT AND FISH **9 Hours**

Egg - Structure, Composition, Nutritive value, Grading, Methods of Cooking and Role of egg in cookery.

Meat - Structure, Composition, Nutritive value, Classes and Grades of meat cuts, Changes on cooking and Rigor mortis. Poultry - Composition, Nutritive value, Grades, Methods of cooking, Effects of cooking.

Fish - Composition, Nutritive value, Types, Cuts, Selection, Spoilage, Cooking and Factors effecting cooking quality.

MILK AND FAT **9 Hours**

Milk and Milk Products - Composition, Nutritive value, Constituents, Properties of milk, Effects of acid, Salt, Heat on milk proteins and coagulation. Milk products - Ice cream,Curd, Butter, Butter milk Cheese and milk powder.

Fats & Oils - Types properties of fat relating to cooking, Rancidity, Tests for radcidity, Hydrogenation, Changes in fat during heating, Factors affecting fat absorption, Shortening, Use of fat in tenderness of cooked products.

SUGAR,BEVERAGES AND SPICES **9 Hours**

Sugar cookery - Types of sugar, Properties, Crystallization, Stages in Sugar cookery,.

Beverages – Classification- alcoholic and non-alcoholic beverages, Nutritive value, Production of beverages. Spices and Condiments – Classification and uses.

Theory: 45 Hours **Total Hours :45**

REFERENCES:

1 Food science, Potter N.N.,CBS publishers & distributors, Delhi,1996.
2 Sri Lakshmi B , Food Science, New Age International Publishers , India,2007
3 Food facts and principles, Sakuntala Manay and shadaksaraswamy, M, AlliedPublishers, New Delhi,2008.

OTHER REFERENCES:

1 Potter N, Food science. CBS publishers & distributors, Delhi,1996.
2. Food chemistry, Meyer L.M.(1969) Van Noustrand Reinhold co., New York.
3. Food Science and experimental foods, Swaminathan, N,Ganesh Publications, Madras,1987.
4. The experimental study of foods, Griswald R.M., Houghton, Muffin Co., New York,1962.

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U14BTE103	BIOFERTILIZER AND BIOPESTICIDE DEVELOPMENT AND CONTROL	L	T	P	C
		3	0	0	3

Objective(s):

- To learn the production process in biofertilizer
- To learn the various process in biopesticide production.
- To learn various environmental application of biofertilizer and biopesticides

Course Outcomes :

CO1 : Students able to understand nitrogen fixing bacteria and soil fertility.

CO2 : Students should learn various production process and formulation of biofertilizer

CO3 : Students should learn various agricultural applications of biopesticides.

CO4 : Students can able to learn biocontrol agents and their applications.

CO5 : Students able to understand various environmental applications..

Pre-requisite:

1 U14BTT302 Microbiology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12
CO1	S	S										
CO2		S										
CO3	S	S	S									
CO4							S					
CO5			M			S	S					

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

SOIL AND AGRICULTURAL MICROBIOLOGY 9 Hours

Soil Habitat; Nitrogen fixation (symbiotic and nonsymbiotic), Microbial interaction; Isolation and screening of industrially important microbes; Large scale cultivation of industrial microbes. Brief account of beneficial microorganisms – *Rhizobium Azotobacter* and *Azospirillum*; Phosphate solubilizing microorganisms; Vesicular Arbuscular Mycorrhizae (VAM); *Azolla*; Blue Green Algae (BGA); Plant growth promoting rhizobacteria (PGPR); Green manure

BIOFERTILIZER PRODUCTION PROCESS AND FORMULATION 9 Hours

Strain selection and improvement; culturing methods; mass production-sterilization; selection of raw material and dose determination, storage and maintenance. Formulation- EC, WP, Granules etc., Quality checking and approval; advantages over inorganic fertilizers.

BIOPESTICIDE PRODUCTION PROCESS AND FORMULATION 9 Hours

Market potential- need and demand; Impact on biopesticides; Formulation; Microbial preparation for agricultural applications- Insecticide, herbicide, Nematicide. Impact on flora and fauna. Pesticide usage trend and its harmful effects, Integrated Pest and Disease Management System (IPDMS); Biological control - conservation of natural enemies, release of parasites, use of microbial agents; Need-based application of pesticides, use of selective pesticide.

BIOCONTROL AGANTS 9 Hours

Biological control of insects - Fungal insecticides, bacterial insecticides - *Bacillus thuringlensls* (BT); Development of resistance; Improvements in BT through genetic engineering; Limitations of BT; Viral insecticides - Nuclear Polyhedrosis Virus; Protozon insecticides; Botanical pesticides; Pheramon trap; Trichocards; Nematodes as biological control agents; Biological control of weeds; Biological control of plant diseases - Soilborne diseases, foliar Diseases

ENVIRONMENTAL APPLICATIONS OF MICROBIAL FERTILIZER **9 Hours**

Different methods for biofertilizer aaplication – granular and liquid; Different methods of inoculation - seed inoculation, top dressing of biofertilizers, broadcasting of granular biofertilizers, granular biofertilizer mixed with seed; Methods of application of liquid inoculation; Methods of application of other biofertilizers; Formulations for biocontrol agents; Factors affecting crop response to biofertilizers; Potential of biofertilizers and biocontrol agents in Indian agriculture.

Theory: 45 Hours **Total Hours :45**

REFERENCES:

1 NIIR Board: The Complete Technology Book on Biofertilizer and Organic Farming National Institute of Industrial Research, New Delhi. (2004)

2 Ghosh G. K: Bio-pesticide and Integrated Pest Management. APH Publishing Corp., New Delhi. (2000)

3 Van Emden HF and Service MW: Pest and Vector Control. Cambridge University Press, UK. (2004)

4 http://saspublisher.com/wp-content/uploads/2013/07/SAJP24327-332.pdf

5 http://www.fnca.mext.go.jp/english/bf/bfm/pdf/5_Quality_Control0403.pdf

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U13BTE104	MOLECULAR AND MICROBIAL PATHOGENESIS	L	T	P	C
		3	0	0	3

Objective(s) :

- Students understand principles of microbial pathogenesis, clinical importance of specific pathogens.

Course Outcomes :

CO1 : Understand principles of microbial pathogenesis, clinical importance of specific pathogens.
CO2 : Learn importance of Host defense mechanisms and pathogen adaptation against host defense.
CO3 : Comprehend molecular mechanisms involved in Pathogenesis of diseases
CO4 : Learn host-pathogen interaction with respect to pathological damage of pathogens.
CO5 : Discern different diagnostic techniques like ELISA, RIA etc.,

Pre-requisite:

1 U14BTT505 Immunology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO11	PO 12
CO1	W											
CO2	M	W		W								
CO3	M	W	W									
CO4		S										
CO5	W											

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

MICROBIAL PATHOGENESIS 9 Hours

Introduction to the infectious diseases - Molecular Koch postulates; Clinical importance of pathogenic bacteria, fungi, virus and parasite with Examples; Principles of microbial pathogenesis- Microbial modes of entry mechanism and colonization; Components of microbial pathogenesis; Inflammation process.

HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 9 Hours

Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors; Introduction to host defense- First line and second line defense mechanisms; Antimicrobial compounds; Mechanism of killing by humoral and cellular defense mechanisms; Pathogenic adaptations to overcome the above defenses; complement system - types of complement system.

MOLECULAR MICROBIAL PATHOGENESIS (SPECIFIC EXAMPLES) 9 Hours

Clinical features and molecular mechanism of pathogenesis: Enteric pathogens- *E.coli* pathogens- Enteropathogenic (EPEC), Enterotoxicgenic (ETEC), Enteroinvasive *E.coli* (EIEC); Shigella ; Salmonella; Vibrio - PAI; Superficial mycoses- Dermatophytes, *Candidiasis;* Malaria – Plasmodium life cycle; Influenza virus: Intracellular stage-H1N1 ; HIV.

EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 9 Hours

Virulence assay: Adherence, cytopathic, cytotoxic; Criteria and tests in identifying virulence factors- Classical, biochemical, genetic and genome approaches; Molecular characterization of virulence factors.

MODERN DIAGNOSIS TO CONTROL PATHOGENS 9 Hours

Modern diagnosis based on highly conserved virulence factors – Immuno and DNA-based techniques- Precipitation, agglutination, ELISA, RIA, PCR, Blotting techniques- Southern and Western blotting; Vaccines – types, applications and their advantages and disadvantages.

Theory: 45 Hours **Total Hours :45**

REFERENCES:

1 David Greenwood, Richard C. B. Slack and John. F. Peutherer (2007) "*Medical Microbiology- A guide to microbial infections: Pathogenesis, Immunity, Lab Diagnosis and Control".* Edn. 16. Churchill Livingstone- An imprint of Elsevier.

2 Peter Williams, Julian Ketley & George Salmond, (1998) "*Methods in Microbiology: Bacterial Pathogenesis",* Vol. 27, Academic Press

3 Camille Locht and Michel Simonet (2012) "Bacterial *Pathogenesis-molecular and Cellular Mechanisms".* Caister Academic Press.

4 Eduardo A. Groisman (2001) "*Principles of Bacterial Pathogenesis"*, Academic Press, USA/UK.

5 Kathleen Park Talaro and Arthur Talaro, (2002) "*Microbiology"*, 4th edition, Mc Graw Hill.

OTHER REFERENCES:

1 http://www.textbookofbacteriology.net/

2 https://www.boundless.com/microbiology/

3 http://www.microbiologybook.org/

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L	T	P	C
3	0	0	3

U14BTE105 FORENSIC BIOTECHNOLOGY

Objectives:

- To learn about forensic science and toxicology
- To understand the concepts of biological evidence collection
- To know about the methods used to identify criminals

Course Outcomes :

CO1 : Outline the basis of forensic science and chemistry
CO2 : Explain the mechanism of toxicology as applied to forensic science
CO3 : Illustrate the concept of biological evidence collection and analysis
CO4 : Explain the basic methods of body fluid analysis
CO5 : Enumerate the role of biotechnology in resolving legal disputes

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry
2 U14BTT404 Cell and Molecular Biology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M		S			M						
CO2				M								
CO3						S						
CO4			M			S						
CO5			S			S						

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

SCOPE OF FORENSIC SCIENCE **9 Hours**

History and Development of Forensic Science, Definition of Forensic Science, Scope of Forensic Science, Need of Forensic Science, Basic Principles of Forensic Science, Tools and Techniques of Forensic Science.

FORENSIC CHEMISTRY **9 Hours**

Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic). Examination of contact Traces: Introduction to cosmetics and detective dyes, collection, sampling and analysis.

FORENSIC TOXICOLOGY **9 Hours**

Introduction, Role of the toxicologist, significance of toxicological findings, poisons, definition, classification on the basis of their origin, physiological action and chemical nature, poisons and poisoning in India, Management of Toxicological cases in the hospital - Signs and symptoms of common poisons, antidotes. Collection and preservation of viscera for various types of poisons: Choice of preservatives, containers and storage.

BIOLOGICAL EVIDENCE **9 Hours**

Importance, nature, location, collection and evaluation. Hair and Fibres: Importance, nature, location, collection, evaluation and tests for their identification. Importance and identification of Botanical evidence as Pollen grains, wood, leaves and seeds.

BLOOD SAMPLING AND ANALYSIS **9 Hours**

Blood: Composition and functions, collection and species identification.Human Blood groups: General Principles, theory of their inheritance, Blood group determination from fresh blood, titer, raulax formation and Bombay blood group. Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption-inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status.

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BODY FLUIDS AND ENZYME ANALYSIS 9 Hours

Semen: Forensic significance, location, collection, evaluation and tests for identification

Forensic significance of other body fluids as saliva, sweat, milk etc. Their collection and identification Polymorphic enzymes: Forensic significance, identification from fresh blood and stains.

PATERNITY DISPUTES AND BIOTECHNOLOGY

Paternity disputes: Causes, Various serological and biochemical methods, calculation of paternity index and probability for paternity and maternity.

Theory: 45Hrs **Total Hours: 45**

REFERENCES:

1 Nanda, B.B. and Tewari, R.K. (2011) *Forensic Science in India*: *A vision for the twenty first century* Select Publisher, New Delhi.
2 Modis (2000): *Medical Jurisprudence & Toxicology*, M. M. Trirathi Press Ltd. Allahabd,
3 S.N. Tiwari (1997): *Analytical Toxicology*, Govt. of India Publications, New Delhi.
4 Chowdhuri, S. (1991): *Forensic Biology*, B P R & D, Govt. of India.
5 Fraser, Roberts J.A (2000): *An introduction to Medical Genetics*.

OTHER REFERENCES:

1 http://study.com/articles/Forensic_Scientist_How_Do_I_Start_a_Career_in_Forensic_Science.html

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U14BTE106	NEUROBIOLOGY AND COGNITIVE SCIENCES	L	T	P	C
		3	0	0	3

Objectives:

- To learn about the neuroanatomy and neurophysiology
- To understand the concept of synaptic transmission and mechanism of action of neurotransmitters
- To know about the bbasic mechanisms of sensations and disorders related to nervous system.

Course Outcomes :

CO1 : Outline the basis of central and peripheral nervous system and describe the structure of neurons and supporting cells

CO2 : Explain the mechanism of action potential conduction and working of voltage dependent channels

CO3 : Illustrate the concept of synaptic transmission and mechanism of action of neurotransmitters

CO4 : Explain the basic mechanisms of sensations with special emphasis on skeletal muscle muscle contraction.

CO5 : Enumerate the mechanisms associated with motivation and describe the disorders associated with nervous system

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry

2 U14BTT401 Cell and Molecular Biology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M		S			M						
CO2				M								
CO3						S						
CO4			M			S						
CO5			S			S						

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

NEUROANATOMY **9 Hours**

Overview of central and peripheral nervous system, Neurons – structure, types and functions; Glial cells – types ; Synapses – types and functions ; myelination ; Blood Brain barrier ;Neural Development; Cerebrospinal fluid – origin and composition ; Spinal cord - functions.

NEUROPHYSIOLOGY **9 Hours**

Resting and action potential; Mechanism of action potential conduction; Voltage dependent channels – sodium and potassium channels; Electrical transmission; information representation and coding by neurons. **Case study** - information representation by neurons

NEUROPHARMACOLOGY **9 Hours**

Synapse formation; Synaptic transmission, neurotransmitters and their mechanism of action – acetyl choline, serotonin and dopamine; fast and slow transmission; hypothalamic control of neuronal function.

APPLIED NEUROBIOLOGY **9 Hours**

Basic mechanisms of sensations – touch, pain, smell, taste; neurological mechanisms of vision and audition; skeletal muscle contraction

BEHAVIOURAL SCIENCE **9 Hours**

Basic mechanisms associated with motivation; regulation of feeding, sleep, hearing and memory; Disorders associated with nervous system – Parkinson’s disease, Alzheimer’s disease, Schizoprenia, Epilepsy, Anxiety and mood disorders – depression , Agrophobia.

Case study - Parkinsons and Alzeimer’s disease.

Theory: 45Hrs **Total Hours : 45**

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REFERENCES:

1 Mark F. Bear, Barry W. Connors and Michael A. Paradiso, *Neuroscience – Exploring the Brain*, 2nd edition, USA, Lippincott Williams & Wilkins.. 2001

2 Mathews G G., *Neurobiology*, 2nd edition, UK, Blackwell Science., 2000

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U14BTE201	GENETIC ENGINEERING OF VALUE ADDED FOODS	L	T	P	C
		3	0	0	3

Objectives:

- To understand the relationship between nutraceuticals and value addition in foods
- To understand various methods of value addition of foods.
- To learn the biological processes for value addition in foods.

Course Outcomes :

CO1 **:** Use the basic and applied knowledge gained through other courses in biotechnology to relate to nutraceuticals and value addition of foods.
CO2 **:** Understand various methods of value addition of foods.
CO3 **:** Perceive the expected benefits of value addition.
CO4 **:** Learn to use genetic engineering to modify and manipulate biological processes for value addition of foods.
CO5 **:** Understand the impact of value addition of foods.

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry
2 U14BTT501 Genetic Engineering

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12
CO1	S	M		W	W	S						
CO2	S	M		M	M	M						
CO3	S	S	M	M	M	M						
CO4	S	M		S	S	M						
CO5	S	M	S	M	M	M						

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

INTRODUCTION TO NUTRACEUTICALS 9hrs

The history and scope of nutraceutical research. Microbial:fermented foods, bakery products, dairy products and mushrooms. Plant foods: cereals,pulses, legumes, oilseeds, vegetables and fruit crops. Fish, poultry, dairy and animal foods.

THE IMPORTANCE OF VALUE ADDITION OF FOODS 9hrs

Major and minor food constituents: Carbohydrates, proteins, fats, vitamins and minerals, value addition, types of value additions.The benefits of value addition to the foods.

VALUE ADDITION BY GENETIC MODIFICATION 9hrs

Value added microbial foods, value added transgenic plants. Value added transgenic animals. Floriculture and flower industry, Modification of farm products for better transportation, storage, consumer preference.

VALUE ADDITION OF FOODS FOR SUITABLILITY TO INDUSTRIAL PROCESSING 9hrs

Improvement of raw materials by conventional methods. Improvement of raw material by application of biotechnology methods. Value added crops, designer crops, improvements of raw material for food processing industry.

IMPACT OF VALUE ADDITION OF FOODS ON FARM, NATIONAL ECONOMY AND TRADE 9hrs

Importance of value added crops in the farms. Improvement in farm value and economy, farmer and industrial partnership. Impact of biotech-products on national economy and international trade.

Theory: 45 Hr **Total Hours :45**

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REFERENCES:

1 Channarayappa, Molecular Biotechnology**:** Principles and Practices,University Press (India) Pvt. Ltd., Worldwide CRC Press,2006.

2 Singh BD, Biotechnology- Expanding Horizons, Kalyani Publishers, Rajindernagar, Ludhiana,2003.

3 Palaniappan SP and Annadurai K , Organic farming,Scientific Publishers(India), Jodhpur,2007.

4 Probir Kanti Biswas ,Agricultural Biotechnology,Dominant Publishers andDistributors, New Delhi,2005.

5 Rajashekaran K, Jacks TJ and Finley JW ,Crop Biotechnology, American
Chemical Society, Washington, DC,2002.

OTHER REFERENCES:

1 Lindsey K and Jones MGK, Plant biotechnology in Agriculture. PrenticeHall, USA,1990.

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U14BTE202	FOOD QUALITY AND SAFETY ASSURANCE	L	T	P	C
		3	0	0	3

Objectives:

- To understand the quality aspects of foods
- To know the food standards and laws
- To learn the general principles of food safety

Course Outcomes :

CO1 : Aware about the important parameters of food quality.

CO2 : Capable of understanding the quality policy and identify the hazards in food industries.

CO3 : Gain knowledge about the general principles of food safety

CO4 : Know about food law and standards

CO5 : Know about various international bodies involved in food standards.

Pre-requisite:

1 U14BTT301 Biochemistry

2 U14BTT302 Microbiology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M	W	W		M	S						
CO2	S	M	M			S						
CO3	S		S	W		S						
CO4	S		S			S						
CO5	S		M			S						

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

FOOD QUALITY **9 Hours**

Quality factors: appearance- size and shape, texture – measuring texture, texture changes, consistency. Flavour Factors – influence of colour and texture on flavor. Taste Panels. Food – related hazards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety. Food additives – preservatives-class I and II, antioxidants, sequestrants, surface active agents, stabilizers and thickeners, bleaching and maturing agents, starch modifiers, buffers, acids, alkalis, food colours, artificial sweeteners, nutritional additives, flavouring agents.

GENERAL PRINCIPLES FOR FOOD SAFETY AND HYGIENE **9 Hours**

Principles of food safety and quality –Food Safety System – Quality attributes- Total Quality Management. Introduction to Risk Analysis, Risk Management, Risk Assessment, Risk Communication. Background and Structure, GHP, GAP, GMP, PRP, OPRP, CP, CCP, Principles and Implementation of HACCP. Traceability and authentication, Certification and quality assurance.

GENERAL PRINCIPLES FOR FOOD SAFETY REGULATION AT NATIONAL/REGIONAL LEVEL **9 Hours**

The Structure of Food Law, Food Regulation What Should be Regulated?, Food laws: Federal Food Drug and Cosmetic Act (1938), Good Manufacturing Practices (Code of GMP), Fair Packaging and Labeling Act (1966), Federal Meat Inspection Act (1906), International Food,Standards and Codex Alimentarius, HACCP and ISO 9000 series.

NATIONAL STANDARDS AND GUIDELINES **9 Hours**

PFA, FPO, FSSAI, MMPO, MPO, AGMARK, BIS, Legal Metrology, Environment and Pollution Control Board, Factory Licence. International food standards., Trends in Food Standardization,An Overview and structure of 9001:2000/2008, Clause wise Interpretation of ISO 9001:2000.

INTERNATIONAL BODIES DEALING IN STANDARIZATION **9 Hours**

International Standardization Organization (ISO), Joint FAO/WHO Food Standards Program.Codex Alimentarius Commission (CAC), Other International Organizations Active in Food Standard Harmonization. Advantages of Utilizing International Standards.

Theory: 45 Hours **Total Hours :45**

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REFERENCES:

1 Neal D. Fortin,Food regulation, Wiley Publishers,2009.

2 Naomi Rees. David Watson,International standards for food safety, An Aspen Publications,2000.

3 Montrille TJ, Matthews KR, Food Microbiology, ASM Press,S2 NW Washington, USA,(2005)-e-book

OTHER REFERENCES:

1 Hayes, P. R, Food Microbiology and Hygiene,Chapman & Hall, 2-6 Boundary Row, London SE 1 BHN,1995)- e-book.

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U14BTE203 **CANCER BIOLOGY**

L	T	P	C
3	0	0	3

Objectives:

- To learn about the fundamentals of carcinogenesis and role of oncogenes
- To understand the regulation of cell cycle in cancer and mechanism of cancer metastasis
- To know about the strategies for cancer diagnosis and therapy

Course Outcomes :

CO1 : Understand the mechanism of proto-oncogene and oncogene and apoptosis

CO2 : Describe the mechanism of cell cycle regulation in cancer

CO3 : Attain the knowledge in the fundamentals of carcinogenesis and its role in cancer

CO4 : Illustrate the mechanism of cancer metastasis and

CO5 : Comprehend the basis of cancer diagnosis and therapy

Pre-requisite:

1 UBTT404 Cell and Molecular Biology

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M		S			M						
CO2				M								
CO3						S						
CO4			M			S						
CO5			S			S						

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

ONCOGENES AND PROTO ONCOGENES 9 Hours

Mechanism of oncogene and proto oncogene – epidermal growth factor (EGF), platelet derived growth factor (PDGF), transforming growth factor (TGF), src and myc; RAS cycle; Oncogenes – Identification and detection; Apoptosis – intrinsic and extrinsic pathways. Genetic rearrangements in progenitor cells

CELL CYCLE REGULATION 9 Hours

Regulation of cell cycle - S. pombe, S. cerevesiae and mammalian system; Types of mutations that cause changes in signal molecules; Effects on receptor; Tumor suppressor genes -p53 and Rb proteins; Modulation of cell cycle in cancer; Mechanism of action of telomerase. Interaction of cancer cells with normal cells

MECHANISM OF CARCINOGENESIS 9 Hours

Carcinogenesis – introduction and types; Chemical carcinogenesis – Direct acting and indirect acting carcinogens; Metabolism of carcinogens - CYP450 reductase mechanism; Mechanism of radiation carcinogenesis – ionizing and non ionizing radiation; Retroviruses - RSV life cycle and its role in cancer; Identification of carcinogens- Long and short term bioassays.

MECHANISM OF CANCER METASTASIS 9 Hours

Metastasis – Introduction and cascade; Clinical significances and three step theory of invasion; Significance of proteases in basement membrane disruption; Properties of cancer cell; Oral, lung, uterus, breast & blood – etiology, diagnosis and treatment.

Case study – oral, breast and blood cancers

CANCER DIAGNOSIS AND THERAPY 9 Hours

Action of cancers – biochemical assays; Tumor markers; Molecular tools for early diagnosis of cancer; Prediction of aggressiveness of cancer; Different forms of therapy – Chemotherapy, Radiation therapy and Immunotherapy; Role of antioxidants in preventing cancer

Theory: 45Hr **Total Hours : 45**

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REFERENCES:

1 Ian F.Tannock, Richard P. Hill, Robert G. Bristow and Lea Harrington., *The Basic Sciences of Oncology*, 4th Edition, The McGraw-Hill Companies, Inc. New Jersey, 2005.
2 Weinberg.,R.A., *The Biology of Cancer*, 1st Edition, Taylor and Francis, Garland Science. United Kingdom., 2007.
3 Pelengaris A.,and M. Khan (Eds)., *The Molecular Biology of Cancer,* Wiley - Blackwell Publishing, USA. 2006.
4 Gareth Thomas.,*Medicinal Chemistry – An Introduction,* 1st Edition, John Wiley and Sons, USA, 2004.
5 Benjamin Lewin., *Genes VIII,* International Edition, Pearson Prentice Hall, New Delhi. 2004.

OTHER REFERENCES:

1 Anthony S. Fauci, Dennis L. Kasper, Stephen L. Hauser, Dan L. Longo, J. Larry Jameson, Braunwald, Fauci and Isselbacher., *Harrison's Principles of Internal Medicine,* 17th Edition, McGraw Hill Medical Publishing Division. NewYork. 2008.

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U14BTE204	STEM CELLS AND TISSUE ENGINEERING	L	T	P	C
		3	0	0	3

Objectives:

- To learn about the biology of stem cells and their differentiation
- To understand the concept of tissue engineering
- To know about the application of tissue engineering in regenerative medicine

Course Outcomes :

CO1 : Understand the basics concepts of stem cells and their differentiation

CO2 : Comprehend the concepts of tissue engineering, scaffolds materials and designing

CO3 : Illustrate the applications of tissue engineering in tissue repair and dysfunction

Pre-requisite:

1 U14BTT505 Immunology

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1			S			M						
CO2					S	M						
CO3		S	M			S						

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

STEM CELLS **9 Hours**

Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Examples- mesenchymal, liver and neuronal stem cells; cord blood banking; telomeres and self renewal; stem cell plasticity.

STEM CELL DIFFERENTIATION **9 Hours**

Culture media for human embryonic and adult stem cells; growth factors; inducible pluoripotent cells

Characterization and Differentiation of human embryonic stem cells -hematopoietic, neural and germ cell differentiation; conceptual and dynamic models of stem cell proliferative behavior.

CONCEPTS IN TISSUE ENGINEERING **9 Hours**

Cells as therapeutic agents- examples; cell numbers and growth rates; Tissue organization – components and types; Tissue dynamics – dynamic states, homeostatsis and tissue repair. Tissue Morphogenesis.

BIOMATERIALS IN TISSUE ENGINEERING **9 Hours**

Microscale patterning of cells and their environment. Cell interactions with polymers, Matrix effects, polymer scaffold fabrication, Biodegradable polymers, Micro and nano fabricated scaffolds, three dimensional scaffolds.

REGENERATIVE MEDICINE **9 Hours**

Medical and surgical therapies for tissue dysfunction; Tissue engineered therapies –Artificial Blood, Tissue Engineering of Bone Marrow .Wound healing process and angiogenesis.

Case study – mesodermal (articular cartilage), ectodermal (skin), endodermal (liver).

Theory: 45Hrs **Total Hours : 45**

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REFERENCES:

1 Thomas C.G. Bosch., *Stem cells – From Hydra to Man*. First Edition, New Delhi, Springer International. 2008.
2 Bernhard Palsson and Sangeeta N Bhatia., *Tissue Engineering, 2nd Edition*, New Delhi, Prentice Hall., 2009.
3 Robert Lanza, Robert Langer, Joseph Vacanti.,*Principles of Tissue Engineering*, Academic Press. 2007.
4 Yoshito Ikada. *Tissue Engineering: Fundamentals and applications*, Elsevier International ProjectsLtd., 2006.

OTHER REFERENCES

1 http://ocw.mit.edu/courses/biology/7-344-the-fountain-of-life-from-dolly-to-customized-embryonic-stem-cells-fall-2007/download-course-materials/
2 https://embryology.med.unsw.edu.au/embryology/index.php/Talk:Lecture_-_Stem_Cells

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U14BTE205 SYSTEMS BIOLOGY

L	T	P	C
3	0	0	3

Objectives:

- To learn and understand the fundamentals of systems modeling and simulation biochemical pathways.

Course Outcomes :

CO1 : Understand the basics of systems modeling
CO2 : Demonstrate the biochemical networks
CO3 : Explain the kinetic models pertaining to cell – cell interactions
CO4 : Understand the advanced modeling networks
CO5 : Understand the computational simulation of framing the biochemical pathways

Pre-requisite:

1 U14BTT301 Concepts in Biochemistry
2 U14CHT205 Chemistry for Biotechnology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M		S	M	W							
CO2	S	S		M	S							M
CO3	S	S	W	S	S							S
CO4	S	M		M	S							W
CO5	S	S	M	M	M							M

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

INTRODCUTION **9 Hours**

Introduction - System-level Understanding of Biological Systems - Advanced Measurement; Systems Modeling Genetic Networks

MODELLING NETWORKS **9 Hours**

Modeling the Activity of Single Gene - A Probabilistic Model of a Prokaryotic Gene and its Regulation Modeling Biochemical Networks - Atomic - Level Simulation and Modeling of Biomacromolecules

KINETIC MODELS **9 Hours**

Kinetic Models of Excitable Membranes and Synaptic Interactions - Stochastic Simulation of Cell Signaling Pathways -Analysis of Complex Dynamics in Cell Cycle Regulation.

ADVANCED MODELLING NETWORKS **9 Hours**

Modeling Large Biological Systems from Functional Genomic Data: Parameter Estimation -Cellular Simulation - Towards a Virtual Biology Laboratory - Computational Cell Biology :The Stochastic Approach

COMPUTATIONAL SIMULATION **9 Hours**

Computer Simulation of the Whole Cell - Computer Simulation of the Cell: Human Erythrocyte Model and its Application - Software for Modeling and Simulation – E-CELL, V- CELL and GROMOS

Theory:45 Hr **Total Hours :45**

REFERENCES:

1 Foundations of Systems Biology, Hiroaki Kitano (Editor),MIT Press, 2001

2 Computational Modeling of Genetic and Biochemical Networks, James M. Bower, Hamid Bolouri, MIT Press,2000.

3 Gene Regulation and Metabolism: Postgenomic Computational Approaches, Julio Collado-Vides (Editor), Ralf Hofestadt (Editor),MIT Press,2002

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U14BTE206	MEDICAL DIAGNOSTICS AND THERAPEUTICS	L	T	P	C
		3	0	0	3

Objectives:

- To study the classification of genetic diseases and mechanism behind the pathogenesis of genetic diseases
- To understand the molecular diagnosis of diseases
- To learn about the therapeutic strategies available for alleviating the symptoms of molecular diseases

Course Outcomes :

CO1 : Understand the classification of genetic diseases
CO2 : Learn the molecular basis behind the pathogenesis of genetic diseases
CO3 : Develop skills in diagnosing the outcome of the diseases
CO4 : Enumerate the gene therapy strategies for alleviating molecular diseases
CO5 : List out the gene products available in medicine to treat the molecular diseases.

Pre-requisite:

1 U14BTT404 Cell and Molecular Biology
2 U14BTT501 Genetic Engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P O11	PO 12
CO1			S			M						
CO2			S			M						
CO3					S	M						
CO4		S				M						
CO5		S			M	W						

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

CLASSIFICATION OF GENETIC DISEASES **9 Hours**

Chromosomal disorders – Numerical disorders, trisomies, monosomies; Chromosomal instability syndromes; Gene controlled diseases – Autosomal and X-linked Disorders; Candidate gene approach – Marfan's syndrome, Alzeimer's disease; Gene Hunting-schizophrenia, bipolar disorder**.**

MOLECULAR BASIS OF GENETIC DISEASES **9 Hours**

Molecular basis of human diseases - Pathogenic mutations, Gain of function mutations –Oncogenes; Huntingtons Disease; lethal bleeding diathesis - Pittsburg variant of alpha 1 antitrypsin; Genomic mprinting -Mechanisms, Praderwilli / Angelman syndrome, Mitochondrial diseases-MELAS, LHON, MERRF; Immuno Pathology.

MOLECULAR & MEDICAL DIAGNOSTICS **9 Hours**

Conventional methods of diagnosis – amniocentesis, ultrasonography; G-banded chromosomal preparations for detection of autosomes of autosomal/sexchromosomal disorder - Down's syndrome; PCR bases diagnosis – fragile-X syndrome; mutation detection by PCR-SSCP - sickle cell anemia; SNP analysis for known SNPs; PAGE- band detection of enzyme variants, Microarray technology- genomic and cDNA arrays, application to diseases.

MOLECULAR THERAPEUTICS **9 Hours**

Gene therapy- *Ex vivo*, *Inv ivo*, *In situ*; Strategies of gene therapy – gene augmentation, antisense therapy; Viral vectors - retrovirus, adenoviruses, Herpes simplex virus; non viral methods - liposomes, receptor mediated gene transfer. Stem cell therapy - Embryonic and adullt Stem Cells, Totipotent, Pluripotent and Mulltipotent Cells; Potential use of stem cells – Cell based therapies; Nanomedicine – Basic approach and clinical application.

THERAPEUTIC GENE PRODUCTS **9 Hours**

Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon; Vaccines-Simple recombinant protein vaccines; Gene vaccines; DNA based vaccines; plant edible vaacines; subunit vaccines, Attenuated Vaccines. Therapeutic antibodies and Immunotherapy; other recombinant proteins – cytokines; colony stimulating factors

Theory: 45 Hrs **Total Hours : 45**

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REFERENCES:

1 Judit Pongracz, Mary Keen., *Medical Biotechnology*, Churchill Livingstone, 2009.

2 Pamela Greenwell, Michelle McCulley., *Molecular therapeutics*: 21st-centurymedicine, John Wiley and Sons, 2008.

3 Sathyanarayana. U., *Biotechnology*, Books and Allied (P) Ltd. 2010.

4 Gary Walsh., Biopharmaceutical technology-biochemistry and biotechnology,Wiley & Sons.2005.

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U14BTE301 NANOBIOTECHNOLOGY

L	T	P	C
3	0	0	3

Objectives:

- To develop the knowledge on nanomaterials synthesis characterization
- To gain knowledge in involvement of macromolecules in nanobiotechnology
- To study the application in drug delivery and cancer treatment

Course Outcomes :

CO1 : Understand the basics of nanobiotechnology and synthesis of nanomaterials

CO2 : Apply the knowledge on characterization of nanoparticles with different techniques

CO3 : Understand the different nanomaterials applications

CO4 : Know the interactions of nanomolecules in biosystem towards applications

CO5 : Discuss the applications of nanotechnology in biotechnology

Pre-requisite:

1 U14CHT101 Engineering Chemistry

2 U14PHT101 Engineering Physics

3 U14BTT201 Biomolecules and Genetics

CO/PO Mapping

S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	S				W						
CO2	S	S	M									
CO3	S		S									
CO4	S		S	M								
CO5	S	S										

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

INTRODUCTION TO NANOBIOTECHNOLOGY 9 Hours

Introduction to Nanotechnology and nanobiotechnology – Properties at nanoscale; overview of nanodevices and techniques. General synthesis methods of nanoscale materials; top down and bottom up approaches, Biological approach to self assembly.

NANOPARTICLES CHARACTERIZATION TECHNIQUES 9 Hours

X-ray diffraction technique, Scanning Electron Microscopy with EDX - Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

NANOMATERIALS AND APPLICATIONS 9 Hours

Inorganic nanoscale systems for biosystems-nanostructure materials – fullerenes, carbon nanotubes, quantum dots and wires - preparation, properties and applications. Nanopores – applications

NANOMOLECULES IN BIOSYSTEMS 9 Hours

Nanomolecules in biosystems -proteins, RNA and DNA-nanoscale elements for delivery of materials into cells - DNA based artificial nanostructures – proteins as components in nanodevices. Tissue regeneration using anti-inflammatory nanofibres, Polymer nanofibers and applications, polymer nanocontainer. magnetosomes, bacteriorhodopsin - applications - S-layer proteins.

APPLICATION OF NANOBIOTECHNOLOGY 9 Hours

NanoBiotechnology in drug delivery - nanoscale devices for drug delivery - micelles for drug delivery – targeting, bioimaging, microarray and genome chips - nanobiosensors and nanobiochips. Nanotechnology for cancer diagnosis and treatment.

Case study on drug delivery of gold nanoparticles against breast cancer.

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Theory: 45 Hr **Total Hours :45**

REFERENCES:

1 Niemeyer, C. M., and CA Mirkin, C. A., (2010) *NanoBiotechnology II – More concepts, and applications*. First edition, Wiley –VCH publications

2 Rosenthal, S.J., and Wrigh, D.W., (2010) *Nanobiotechnology Protocols*, First Edition, Humana Press

3 Jain, K. K (2006) *NanoBiotechnology in molecular diagnostics – current technique and applications*, First edition, Taylor and Francis

OTHER REFERENCES:

1 Oded shoseyov & Ilan Levy (2008) *Nanobiotechnology – Bioinspired and materials of the future*. Humana press, New Jersey

2 http://www.understandingnano.com/nanoparticles.html

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U14BTE302	CLINICAL RESEARCH & MANAGEMENT	L	T	P	C
		3	0	0	3

Objective:

- To be the biggest knowledge enhancement movement in the world in the area of Clinical Trial, Research & Administration

Course Outcomes :

CO1 : Enhance and share knowledge in the emerging areas of Clinical Trial, Research & Administration

CO2 : Develop documentation / research writing expertise in the Clinical Trial, Research & Administration area.

CO3 : Able to spread awareness in this area by sharing their knowledge with others.

CO4 : Platform for interchange and exchange of knowledge in this area

CO5 : To conduct ethical Clinical Trial, Research & Administration leading to better opportunities and higher quality of life

Pre-requisite:

1 U14BTT603 Biopharmaceutical Technology

2 U14BTT505 Immunology

CO/PO Mapping

(S/M/W indicates strength of correlation)

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	W											
CO2	M	W		W		M						
CO3	M	W	W		S							
CO4		S										
CO5	W				W							

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

CLINICAL TRIALS **9 Hours**

Basics of Clinical Trials & Clinical Research Clinical Trials T erminology Features of Clinical Trials Good Clinical Trial Practices Patient Recruitment Clinical Trial Statistics Bioavailability Studies Research Methodology Design of Experiments Clinical Trial Informatics Clinical Trial T eam Clinical Trial Delivery Model Clinical Trial Business Environment Clinical Trial Regulatory Affairs Bioethics Audit of Clinical Trials Case Studies

CONTRACT RESEARCH **9 Hours**

Basics of Contract Research Contract Research Organization Academic Research Organization Contract Research Areas Contract Research Delivery Model Contract Research Business Environment Contract Research Information Sources IT and Contract Research Regulatory Affairs and Contract Research Case Studies

CONTRACT RESEARCH AND CLINICAL TRIAL ENVIRONMENT **9 Hours**

An introduction of contract research need of contract research organizations description, features and benefits of contract research. Contract research organizations in india complimentary and alternative medicine (cam) Contract research and clinical trial environment in india. Non-clinical safety studies for the conduct of human clinical trials for pharmaceuticals. Choice of control group and related issues in clinical trials purposes of clinical trials and related issues Detailed consideration of types of control external control (including historical control)

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GUIDELINES ON BIOMEDICAL RESEARCH ON HUMAN SUBJECTS **9 Hours**

Statement of general principles on ethical Considerations involving human subjects. Ethical review procedures. General ethical issues. Statement of specific principles for clinical. Evaluation of drugs/devices/diagnostics/ Vaccines/herbal remedies. Statement of specific principles for Epidemiological studies. Statement of specific principles for human Genetics research. Statement of specific principles for research In transplantation including foetal tissue Transplantation. Statement of specific principles for assisted Reproductive technologies.

SCHEDULE - Y **9 Hours**

Application for permission. Approval for Clinical Trial. Responsibilities of Sponsor. Responsibilities of the Investigator(s). Informed Consent. Responsibilities of the Ethics Committee. Human Pharmacology (Phase I). Therapeutic exploratory trials (Phase II). Therapeutic confirmatory trials (Phase III). Post Marketing Trials (Phase IV). Studies in Special Populations. Post Marketing Surveillance. Special Studies: Bioavailability / Bioequivalence Studies.

Theory:45 Hr **Total Hours :45**

REFERENCES:

1 Bengt D. Furberg , Curt D. Furberg, (2007) "Evaluating Clinical Research: All That Glitters is Not Gold" 2nd edition , Springer publications

2 Stephen B Hulley, Steven R Cummings, Warren S Browner, Deborah G Grady, Thomas B Newman,(2008) Designing clinical research, Second edition Lippincott Williams & Wilkins Publishers

3 John I. Gallin and Fredrick P.Ognibene (2007). Principles and Practice of Clinical Research , Second Edition, Academic press

4 Antonella Bacchieri, Giovanni Della Cioppa (2007). Fundamentals of Clinical Research , First edition, Springer publishers

OTHER REFERENCES:

1 http://onlinelibrary.wiley.com/book/10.1002/9780470010167

2 http://clinicalcenter.nih.gov/training/training.html

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U14BTE303 **ENVIRONMENTAL TOXICOLOGY AND OCCUPATIONAL HEALTH**

L	T	P	C
3	0	0	3

Objectives:

- To learn the principles of toxicology and to evaluate the effects of occupational hazard on health.

Course Outcomes :

CO1 Learn the biochemical aspects of pollutants in environment.
CO2 Understand about biotransformation and detoxification.
CO3 To apply indices of toxicity in occupational health.
CO4 To assess epidemiological aspect of toxins.
CO5 Evaluate various testing procedures.

Pre-requisite:

1 U14GST001 Environmental Sciences and Engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1				M			M					
CO2				M								
CO3			S				M					
CO4							M					
CO5			M	M	M		M					

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

TOXICANTS OF ENVIRONMENT **9Hour**

Toxic chemicals in the environment, Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, Ozone and particulates.

MECHANISMS OF TOXICITY **9Hour**

Mode of entry of toxic substance, biotransformation of xenobiotics, detoxification. Chemical carcinogenics, mechanism of carcinogenicity.

INDICES OF TOXICITY **9Hour**

Indices of toxicity – threshold dose, LD50 and LC50, MIC & IC50 Dose – response relationship. Forensic toxicology. Factors affecting toxicity of a chemical agent.

FACTORS OF ENVIRONMENTAL HEALTH **9Hour**

Biogeochemical factors in occupational health. Epidemiological issues-goiter, fluorosis, arsenic poisoning.

SUSTAINABLE DEVELOPMENT OF ECOSYSTEM **9Hour**

Tissue toxicity, interference in enzyme activity, interference in nucleic acids and protein biosysnthesis. Detection – Testing chemicals for their carcinogenic, mutagenic and teratogenic actions. Case Studies.

Theory: 45 **Total Hours : 45**

Text book:

1 R.B. Philip, Environmental hazards & human health, CRC press, Florida, USA, 2013.

2 Levy B, Wegman D.H., Baron S.L., Sokas R.K., Occupational and Environmental Health: Recognizing and Preventing Disease and Injury, Oxford University Press, USA, 2011.

3 Maxwell N.C., Understanding Environmental Health: How We Live in the World, Jones & Bartlett Learning, USA, 2014.

4 Niesink and Devries J, 1996, Toxicology - principles & applications, CRC Press, USA, 1996.

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Web refrences:

1 http://www.atsdr.cdc.gov/training/toxmanual/modules/1/lecturenotes.html
2 http://www.webpages.uidaho.edu/etox/lectures.htm
3 http://ocw.mit.edu/courses/biological-engineering/20-104j-chemicals-in-the-environment-toxicology-and-public-health-be-104j-spring-2005/lecture-notes/
4 http://ocw.jhsph.edu/courses/publichealthtoxicology/lectureNotes.cfm

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U14BTE304	ENVIRONMENTAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

Objectives:

To equip the students in understanding various aspects of the environment and how Biotechnology could be applied in finding sustainable solutions to environmental issues.

Course Outcomes :

CO1 : Identify the key concepts in ecosystems management
CO2 : Summarize wastewater characteristics and treatment protocols
CO3 : Construct systems for biotreatment of industrial effluents and solid wastes
CO4 : Review the biodegradation pathways for xenobiotic compounds
CO5 : Apply the concepts in developing environment-friendly bioproducts

Pre-requisite:

1 U14GST001 Environmental Sciences and Engineering
2 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S					W	M					
CO2	S				M		S					
CO3	S		M		W		S					
CO4	S	M	S				S					
CO5		S					M					

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

ECOSYSTEMS AND THEIR MANAGEMENT 9 Hours
Microbial communities of air, water and soil ecosystems; ecological adaptations and interactions between microorganisms; biogeochemical role of microorganisms; soil, air and water pollution – types, causes and effects; contributions of biotechnology to environmental management; environmental monitoring and risk assessment Case study: environmental impact assessment (EIA)

WASTEWATER TREATMENT 9 Hours
Physical, chemical and biological characteristics of wastewater; wastewater treatment – overview of physical and chemical methods; biological methods - suspended growth and biofilm processes; design of activated sludge process; ponds and lagoons; trickling filters; anaerobic reactors for wastewater treatment; sludge digestion - design of anaerobic sludge digesters; tertiary treatment - nitrogen and phosphorus removal

INDUSTRIAL AND SOLID WASTE MANAGEMENT 9 Hours
Leather, pulp, pharmaceutical, dairy and textile industries – production process, origin and characteristics of waste, waste minimization and treatment options; solid waste management – segregation, collection, transportation, characterization, disposal methods – sanitary landfill, incineration, composting and vermicomposting, recovery of energy from solid waste; hazardous waste management – biomedical waste
case study: solid waste management in Indian cities

BIODEGRADATION AND BIOREMEDIATION 9 Hours
Xenobiotics - factors causing molecular recalcitrance; microbial pathways for biodegradation of petroleum hydrocarbons – aliphatic, alicyclic, single-ringed and polycyclic aromatics, chlorinated hydrocarbons; biodegradation of pesticides and synthetic detergents, bioremediation – types and applications, use of genetically engineered microorganisms in bioremediation; role of biosurfactants in bioremediation

APPLICATIONS OF ENVIRONMENTAL BIOTECHNOLOGY 9 Hours
Biocatalysts for environmental applications; biocontrol agents – biofertilizers and biopesticides; biopolymers; bioleaching; biofuels; biodiversity – values and threats faced, biodiversity conservation and role of biotechnology in it; intellectual property rights and patenting

Theory: 45Hrs **Total Hours : 45**

REFERENCES:

1 Rittman B. and Mac Carty L., Environmental Biotechnology: Principles and Applications, New York: McGraw Hill Publishing Company, 2007.

2 Peavy S., Rowe R. and Tchobanoglous, Environmental Engineering, New York: McGraw Hill Publishing Company, 2010.

3 Patwardhan AD., Industrial Wastewater Treatment. New Delhi: PHI Learning Pvt. Ltd., 2008.

4 Atlas R.M. and Bartha R., Microbial Ecology: Fundamentals and Applications, 6th edition, Benjamin / Cummings Publishing Company, 2008.

5 Metcalf and Eddy, Wastewater Engineering: Treatment and Reuse, 5th edition, New Delhi: Tata McGraw Hill Publishing Company, 2007.

OTHER REFERENCES:

1 http://www.mhhe.com/engcs/civil/rittmann/

2 http://unaab.edu.ng/colleges/environmental-resources-management/environmental-management-and-toxicology/lectures-notes.html

3 http://home.engineering.iastate.edu/~tge/ce421-521/lecture.htm

U14BTE305	THERMOCHEMICAL CONVERSION OF BIOMASS	L	T	P	C
		3	0	0	3

Objective:

To make the students to develop basic understanding of thermochemical conversion technologies

Course Outcomes :

CO1 To understand the Biomass resources, types of biofuels and the bio-refinery concept

CO2 To understand the concept of pyrolysis

CO3 To understand the concept of gasification

CO4 To understand the concept of gasifier

CO5 To understand the concept of torrefaction

Pre-requisite:

1 U14BTT304 Biochemical Process Calculations

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	P O8	PO 9	PO 10	PO 11	PO 12
CO1							S					
CO2							S					
CO3			S		M	M	S					M
CO4					M	M	M					
CO5			S	M	S	S	S					

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

THERMOCHEMICAL CONVERSION TECHNOLOGIES 9 hrs
Biomass, thermochemical conversion technologies- combustion, pyrolysis, gasification, liquefaction and torrefaction

PYROLYSIS 9 hrs
Mechanism, types, products and yield, kinetics, heat transfer, pyrolysis equipments design

GASIFICATION 9 hrs
Reactions and steps, process, kinetics, models, products and applications

GASIFIERS 9 hrs
Types, fixed bed gassifiers, moving bed gassifiers, moving bed gassifiers, entrained flow gassifiers, plasma gassifiers, process design, performance and operating issues

TORREFACTION 9 hrs
Mechanism, advantages, basics of torr, torr reduction

Lectures:45 **Total Hours : 45**

REFERENCES:

1 Prabir Basu, Biomass gasification and pyrolysis: Practical design and theory (2010) Elsevier Inc., USA.
2 Rezaiyan. J and N. P. Cheremisinoff, "Gasification Technologies, A Primer for Engineers and Scientists", Taylor & Francis, 2005

OTHER REFERENCES:

1 www.jie.or.jp/biomass/AsiaBiomassHandbook/English/Part-4_E.pdf
2 www.nrel.gov/docs/gen/fy04/36831e.pdf

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U14BTE401 BIOMATERIALS

L	T	P	C
3	0	0	3

Objectives:

- To learn the basic concepts of the structures of various biomaterials
- To understand the mechanical properties, degradation and processing of biomaterials
- To understand the fundamentals of surface engineering and cell-biomaterial interactions
- To know the applications of biomaterials

Course Outcomes :

CO1 : Know and understand the structures of various biomaterials
CO2 : Demonstrate the mechanical properties of the biomaterials
CO3 : Explain the various methods of the improvement of mechanical properties of different biomaterials
CO4 : Remember the basics of surface engineering and protein-biomaterial interactions
CO5 : Apply the biomaterials in the healthcare sectors

Pre-requisite:

1 U14CHT101 Engineering Chemistry
2 U14PHT206 Applied Physics
3 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M		M	W							M
CO2	S	M	S	S	S							M
CO3	S	S	M	M	S	M						M
CO4	S	M	W	S	M	W						M
CO5	S	M	W	M	M	S						M

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

INTRODUCTION AND STRUCTURE OF BIOMATERIALS **9 Hours**

Introduction and definition of a biomaterial; types and applications of biomaterials; Biological response to biomaterials; Crystal structure of metals; Crystal structure of ceramics; Carbon based materials; General structure of polymers; Synthesis of polymers.

MECHANICAL PROPERTIES OF BIOMATERIALS **9 Hours**

Tensile and shear properties – molecular causes of elastic and plastic deformation, stress-strain curves of elastic and plastic deformation; Bending properties; Time dependent properties – creep properties of polymers; Influence of porosity and the degradation of mechanical properties; Introduction to fatigue.

BIOMATERIAL DEGRADATION AND PROCESSING **9 Hours**

Fundamental of corrosion – redox reactions; Pourbaix diagram; Introduction to crevice and pitting corrosion; Degradation of polymers – hydrolysis and oxidation; Introduction to biodegradable polymers; Process to improve the mechanical strength of biomaterials – metals, ceramics and polymers; Processing of polymers to form desired shapes. Processing to improve biocompatabilty.

SURFACE ENGINEERING AND CELL & PROTEIN INTERACTIONS WITH BIOMATERIALS **9 Hours**

Surface modification of biomaterials – plasma treatment, radiation grafting, self assembled monolayers (SAMs), Langmuir – Blogett films and covalent biological coatings; Protein properties that affect biomaterial surface interaction; biomaterial surface interaction that affect interactions with proteins; Protein adsorption kinetics; DLVO model for cell adhesion; Assays to determine the effects of cell-material interactions – agar diffusion assay, adhesion assays and migration assays.

APPLICATIONS OF BIOMATERIALS 9 Hours

In vitro assays for inflammatory response due to biomaterial implantation; Fibrous encapsulation of healing process; Ideal features of soft tissue implants; Applications of sutures; Dental implants; Eye and ear implants; Heart valves; EndovascularStents.

Theory: 45 Hr Total Hours : 45

REFERENCES:

1 J.S. Temenoff and A.G. Mikos. Biomaterials: The intersection of Biology and Materials Science. Pearson. (2009).

2 Joon Park and R. S. Lakes. Biomaterials – An introduction, 3rd Edition, Springer Science + Business Media. LLC, (2007).

3 Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Biomaterials Science: An introduction to Materials in Medicine, 3rd Edition, (2004).

OTHER REFERENCES

1 http://nptel.ac.in/courses/113104009/

2 http://www.bioen.utah.edu/faculty/pat/Courses/biomaterials/coursenotes.html

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U14BTE402 **STRUCTURAL BIOINFORMATICS AND COMPUTER AIDED DRUG**

L	T	P	C
3	0	0	3

Objectives:

- To understand structural bioinformatics and its relevance to modern biology
- Learn about structure elucidation and prediction
- Understand principles of drug discovery

Course Outcomes :

CO1 **:** Describe the various structural databases and their data access

CO2 **:** Describe conformational analysis of proteins

CO3 **:** Understand the various structure prediction methods

CO4 **:** Explain the mechanisms of drug modeling and design

CO5 **:** Understand the principles of structure based drug design

Pre-requisite:

1 U14BTT701 Advanced Bioinformatics

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	S											
CO2	S											
CO3	S		M									
CO4	M		M									
CO5	W	S	S			S		M				M

Course Assessment methods:

Direct		**Indirect**	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

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Course Content

STRUCTURAL DATABASES AND GENOMICS: 9 Hours

Diversity of Living Organisms: Cells and Cell theory; cell types and Structure; Cell division in prokaryotes and eukaryotes; Central dogma and information flow; Cell metabolism-Homoeostasis- Cell growth, reproduction, differentiation and stem cells.

CONFORMATIONAL ANALYSIS: 9 Hours

Proteins: Forces that determine protein structure, polypeptide chain geometries – Ramachandran Map – potential energy calculations, observed values for rotation angles – structure comparison and alignment;
Nucleic acids and carbohydrates: general characteristics of nucleic acid structure – geometries, glycosidic bond – rotational isomers and ribose puckering - forces stabilizing ordered forms – base pairing –base stacking

DETERMINATION AND PREDICTION OF STRUCTURE 9 Hours

X- ray crystallography – X–ray diffraction, determination of molecular structures, neutron scattering, NMR spectroscopy, Algorithms for prediction of structure of peptides, proteins and nucleic acids. prediction of secondary structure – Chou- Fasman, Garnier-Osguthorpe-Robson (GOR) methods – transmembrane structure prediction – solvent accessibility calculations and prediction. Homology modeling and abinitio modeling. Constructing and Evaluating a Comparative Model. Comparison of Protein Structure Prediction Methods: CASP.

MOLECULAR MODELING, DRUG DESIGN AND DISCOVERY 9 Hours

Communication at the cellular level - Signal transduction (insulin/epinephrine example); Communication at the organ and systems level (blood glucose regulation); Body response to the outside world (neuro-muscular coordination); Body response to the outside world (cell mechanics–chemotaxis, pheromones-one example each)

PRINCIPLES OF DRUG DISCOVERY AND DESIGN: 9 Hours

General approach to discovery of new drugs - lead discovery – lead modification – physiochemical principles of drug action – drug stereo chemistry –drug action - 3D database search – computer aided drug design – docking - molecular modeling in drug design – structure based drug design – pharmacophores - QSAR.

Theory: 45 Hours **Total Hours :45**

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REFERENCES:

1 Cantor R., Schimmel P.R., (2000)*Biophysical Chemistry*, Vol. I, II, W.H. Freeman & Co.,
2 Daniel. M, (1998) *Basic Biophysics for Biologists*, Oxford Publisers.

OTHER REFERENCES:

1 Kensal E. van Holde, W. Curtis Johnson and P. Shing Ho, *Principle of Physical Biochemistry*, (1998), Prentice Hall, New York
2 P.E. Bourne and H. Weissig (Eds.) (2012) *Structural Bioinformatics*, John-Wiley and Sons,.
3 C. Branden and J. Tooze, (2010) *Introduction to Protein Structure*, Garland Publishing Inc., New York.,
4 http://www.cs.cmu.edu/~ckingsf/bioinfo-lectures/

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U14BTE403	ENVIRONMENTAL BIOTECHNOLOGY RISK AND IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Objectives:

To learn and practice environmental impact and risk assessment and to assess and evaluate the risk/ impact involved in environmental biotechnology.

Course Outcomes :

CO1 Outline the concepts of environmental impact assessment.

CO2 Understand various legislation and implementation of risk assessment.

CO3 Designing of various audits and LCA

CO4 Apply the concepts for hazard identification and risk characterization.

CO5 Evaluate the risk of GMOs

Pre-requisite:

1 U14GST001 Environmental Sciences and Engineering

2 U14BTT404 Cell and Molecular Biology

3 U14BTT501 Genetic Engineering

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1							M					
CO2							M					
CO3			S		M		S					
CO4					M	M	S					
CO5			M	M	S	S	M					

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

CONCEPTS OF RISK ASSESSMENT 9 Hours

Introduction to environmental impact analysis, Environmental impact statement and Environmental management plan, ISO14000. Mitigation – Matrices – Checklist.

ECOSYSTEM FUNCTIONS 9 Hours

Impact assessment methodologies, Generalized approach to impact analysis. Rapid and Comprehensive EIA – Legislative and Environmental clearance procedures in India – Prediction tools for EIA.

ECO-TECHNOLOGIES 9 Hours

Documentation of EIA – Environmental Management plan – Post project monitoring – Environmental Audit; Guidelines for Environmental Audit, Baseline information and prediction. Life cycle assessment – EMS - Case studies in EIA. Restoration and rehabilitation technologies.

ECOLOGICAL ENGINEERING APPLICATIONS 9 Hours

Risk analysis - definition of risk, Environmental risk analysis, risk assessment and risk management, Basic steps in risk assessment - hazard identification, dose- response assessment, exposure assessment, Risk characterization.

SUSTAINABLE DEVELOPMENT OF ECOSYSTEM 9 Hours

Environmental biotechnology risk and impact assessment matrix. Application, ethical and legal issues, on genetically modified microorganisms; risk groups; biosafety standards & measures; Expert committees (RDAC, GEAC, SBCC, DLC); environmental approval.

Theory:45 Total Hours : 45

REFERENCES:

1 J Glasson, Therivel R, Chadwick A, Introduction to Environmental Impact Assessment (Natural and Built Environment Series), Routledge , UK, 2011.

2 Therivel R , Strategic Environmental Assessment in Action, Routledge, UK, 2010.

3 Carrol B, Turpin T, Environmental Impact Analysis Handbook, ICE

publisher, London, UK, 2010.
4 Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 1997.

OTHER REFERENCES:

1 Levin M.A, Strauss H.S., Risk Assessment in Genetic Engineering: Environmental Release of Organisms (Environmental Biotechnology), Mc Graw Hill, USA, 2000.
2 Ripp S, Henry T.B., Biotechnology and Nanotechnology Risk Assessment: Minding and Managing the Potential Threats around Us. ACS publications, USA, 2011.
3 Fulekar M.H., Environmental Biotechnology, CRC Press USA, 2011.

Web References:

1 http://www.gdrc.org/uem/eia/impactassess.html
2 http://unaab.edu.ng/colleges/environmental-resources-management/environmental-management-and-toxicology/lectures-notes.html
3 http://www.ce.utexas.edu/prof/maidment/risk/risksyl.html

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U14BTE404 BIOFUELS ENGINEERING

L	T	P	C
3	0	0	3

Objective:

- Evaluate and select appropriate software, modelling tools and techniques for performance and optimisation of biofuels processes,
- predicting the performance of biofuels processes and biomass energy conversion systems

Course Outcomes :

CO1 : Understand in depth the current theory and practice of biofuels production processes.

CO2 : Critically evaluate the current techniques and bioprocesses appropriate for the production of biofuels.

CO3 : Review and assess the technical and economic issues involved in the design and operation of biofuels plants.

CO4 : Recognise and appraise the different techniques and feedstocks use for the production of biofuels.

CO5 : Describe and appraise current research activities in selected topics in the area of biofuels from a technical, economic and environmental perspective.

Pre-requisite:

1 Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1							S					
CO2							S					
CO3			S		M	M	S					M
CO4					M	M	M					
CO5			S	M	S	S	S					

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

Course Content

CLASSIFICATION AND RESOURCES 9 Hours

Introduction, Biofuel as a renewable energy, Classification of biofuels - First, second, third and fourth generation biofuels, Different plant sources as biofuel feedstocks, Biogases, Physical and chemical characteristics of vegetable oils - iodine number, hydroxyl, acid values, rancidity, hydrogenolysis and hydrolysis, Food vs. energy, Edible and non-edible oils as fuels - their extraction

BIODIESEL 9 Hours

Definition, basics and chemistry of biodiesel, vegetable oils in biodiesel production, Transesterification: Chemical methods, enzymatic methods and types of catalysts, separation and purification, physical properties and characterization of biodiesel - Cloud point, pour point, cold filter plugging point, flash point, viscosity and cetane number. Purification - washing and drying options (bubble and mist washing), storage.

QUALITY BIODIESEL AND ENVIRONMENT 9 Hours

Producing Quality Biodiesel, quality control, test methods, ASTM specifications. Oxidative and thermal stability, estimation of mono, di, triglycerides and free glycerol, engine performance test, blending of ethanol with biodiesel, blending of biodiesel with high speed diesel (HSD) and their combustion properties. Comparison of biodiesel with high speed diesel

BIOETHANOL AND BIOGASES 9 Hours

Ethanol as a fuel, microbial and enzymatic production of ethanol from biomass – lignocellulose, sugarcane, sugar beet, corn, wheat starch, purification - wet and dry milling processes, saccharification - chemical and enzymatic .Production of biomethane and biohydrogen. Enzymes employed in the fermentation of sugars to ethanol and ethanol estimation.

BIOREFINERIES **9 Hours**

Definition and types of biorefineries, co-products of biorefineries - oil cake and glycerol, purification of glycerol obtained in biodiesel plant; anaerobic and thermal gasification of biomass, economics of biorefineries, Application of biorefinerie in chemical, pharmaceutical and polymer industries

Theory:45hrs **Total Hours : 45hrs**

REFERENCES:

1 Caye Drapcho, John Nghiem and Terry Walker, Biofuels Engineering process technology, McGraw Hill Professional, 2008

2 Mousdale, Biofuels , CRC Press, 2008

3 Ahindra Nag, Biofuels Refining and Performance, McGraw Hill Professional, 2007.

4 William H. Kemp, Biodiesel Basics and Beyond: A Comprehensive Guide to Production and Use for the Home and Farm, Aztext Press, 2006

5 Lisbeth Olsson, Biofuels (Advances in Biochemical Engineering/ Biotechnology), Springer, 2007

OTHER REFERENCES:

1 http://www.intechopen.com/books/biofuel-s-engineering-process-technology/the-challenge-of-bioenergies-an-overview

2 http://www.intechopen.com/books/biofuel-s-engineering-process-technology/bioresources-for-third-generation-biofuels

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U14BTE405	ECOLOGICAL AND ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

Objectives:

- To learn the concepts in ecology and environmental engineering, to apply these concepts in sustainable development and restoration of ecology and environment.

Course Outcomes :

CO1 Outline the concepts of ecosystem and environmental interactions
CO2 Understand the ecosystem functions
CO3 Designing and construction of eco-agri engineering systems
CO4 Apply the concepts of ecological engineering in ecosystem rehabilitations
CO5 Development of sustainable ecosystems

Pre-requisite:

1 U14GST001 Environmental Sciences and Engineering
2 U14BTT302 Microbiology

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1							S					
CO2							S					
CO3			S		M	M	S					M
CO4					M	M	M					
CO5			S	M	S	S	S					

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

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Course Content

PRINCIPLES AND CONCEPTS **9 Hours**

Scope and applications of Ecological and environmental engineering – Development and evolution of ecosystems. Principles and concepts pertaining to species, populations and community.

ECOSYSTEM FUNCTIONS **9 Hours**

Energy flow and nutrient cycling – Food chain and food webs – biological magnification, diversity and stability. Biochemical cycles. Habitat ecology - Terrestrial, freshwater, estuarine and marine habitats.

ECO-TECHNOLOGIES **9 Hours**

Design and construction of sustainable systems. Application of ecological principles, self design and self-control of ecosystem properties. Sustainable artificial systems from different cultures. Agro-ecological engineering. Modeling as eco-technology.

ECOLOGICAL ENGINEERING APPLICATIONS **9 Hours**

Bio-monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles – step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for wastewater, Reuse of treated wastewater through ecological systems.

SUSTAINABLE DEVELOPMENT OF ECOSYSTEM **9 Hours**

Traditional vs. sustainable exploitation of ecosystems. Distribution of ecosystems and restoration possibilities. Case studies of integrated ecological engineering systems.

Theory:45 **Total Hours : 45**

REFERENCES:

1 Mines R.O, Environmental Engineering: Principles and Practice, Wiley, New York, P662, 2014.

2 William J. M and Jorgensen S.E., Ecological Engineering and Ecosystem Restoration. John Wiley and Sons, New Jersey, Canada, 2013.

3 Kangas, P.C. and Kangas, P., Ecological Engineering: Principles and Practice, Lewis Publishers, New York, 2003.

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4 Mitch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley and Sons, 1996.

OTHER REFERENCES:

1 Etnier, C and Guterstam, B., Ecological Engineering for Wastewater Treatment", 2nd Edition, 1996.
2 Kormondy, E.J., Concepts of Ecology, Prentice Hall, New Delhi, 1996.

OTHER REFERENCES:

1 http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-020-ecology-ii-engineering-for-sustainability-spring-2008/lecture-notes/
2 http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-018j-ecology-i-the-earth-system-fall-2009/lecture-notes/
3 http://www.aboutcivil.org/environmental-science-engineering.html

ONE CREDIT INDUSTRIAL COURSES

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L	T	P	C
1	0	0	1

U14BTIN001 DAIRY TECHNOLOGY

Objectives:

- To understand and learn about various aspects of milk.
- To learn in detail about milk processing techniques and products.

Course Outcomes :

CO1: Understand the basics of milk.
CO2: Learn about various processing techniques of milk.
CO3: Explain the different dairy products.

Prerequisite courses: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S		M									
CO3	SM M											

Course Content

Milk basics **3 Hours**

Milk: Composition – factors affecting milk composition – nutritive value of milk – physicochemical properties of milk & milk constituents – microbiology of milk.

Milk Processing **3 Hours**

Milk Processing – collection storage – receptor (platform tests) – pasteurization – sterilization – homozenization – centrifugation – membrane separation – cooling – packing .

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Equipments used in dairy industry **3 Hours**

Coolers, pasteurizers, sterilizers – homogenizes – centrifuges – membrane separation unit – packaging equipments, FFS machine, Vacuum packaging, dryers.

Quality Control in Milk **3 Hours**

Judging and grading of milk – plat form tests (smell, appearance, sediment, temperature, acidity, lactometer) sampling – testing – Clean-in-place (CIP) – (HACCP)Hazard Analysis and Critical Control Point – Good Manufacturing Practices(GMP), National & International standards of milk & Milk Products.

Milk Products **3 Hours**

Milk Products Butter – Cheese – Ice Cream, Ghee etc. Waste Management – Whey, Whey Proteins – Solids –New Product Development. Visit to Sakthi dairy- Testing milk and products.

Theory: 15 Hrs **Total Hours :15**

References

1 Sukumar De, Outlines of dairy technology,1st Edition,Oxford University Press, 1980.

2 EIRI ,Hand book of milk processing, dairy products and packaging technology, Engineers India Research In, 2007.

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U14BTIN002	MUSHROOM TECHNOLOGY	L	T	P	C
		1	0	0	1

Objectives:

- To understand and learn about various edible mushrooms that are commonly cultivated and consumed.
- To learn in detail on cultivations steps and practices for edible mushrooms and their beneficial effects on human health.

Course Outcomes :

CO1: Understand biology of edible mushrooms

CO2: Cultivation techniques of button, oyster,milky and paddy straw mushrooms.

CO3: Explain the various nutritive value and their therapeutic effects

Prerequisite courses: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S		M									
CO3	SM M											

Course Content

Biology of Mushrooms **2 Hours**

Classification fungi, life cycle of fungi, parts of a typical mushroom , properties of edible mushrooms, differentiating edible mushroom from poisonous mushrooms. Different types of Button, Oyster, Milky and Paddy straw mushrooms- General morphology.

Mushroom Cultivation techniques **8 Hours**

Cultivation systems- Button mushroom, Oyster mushroom, Milky mushroom and Paddy straw mushroom.Problems and remedial measure in edible mushroom cultivation.

Nutritional statistics and beneficial effects of edible mushrooms **5 Hours**

Carbohydrate, protein, essential aminoacids, fats, vitamins, polyphenols and antioxidants calorific values, of edible mushroom fruiting bodies. Antiviral , antibacterial effect, antifungal effect, anti-tumour effect, therapeutic properties of edible mushrooms.

Theory: 15 Hr **Total Hours :15**

REFERENCES:

1 Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).

2 Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.

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U14BTIN003	PILOT-PLANT AND INDUSTRIAL FERMENTORS	L	T	P	C
		1	0	0	1

Objective(s):

- To learn about ancillaries of pilot-plant and industrial fermentors
- To understand the need of pilot-plant fermentors
- To learn the applications of pilot-plant fermentors

Course Outcomes :

After successful completion of this course, the students should be able to

CO1 : Understand the basic components of pilot-plant fermentors
CO2 : Outline the importance of pilot-plant fermentor in biotech. industries
CO3 : Learn about components of industrial fermenter

Pre-requisite:

1 Principles of bioprocess engineering

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	S										
CO3	SM		M	SS								

Course Content

PILOT-PLNT FERMENTER:

Advantages and types of pilot-plant fermenters, Design and operation of pilot-plant fermentors; Material of construction, aeration and agitation, temperature control, automatic antifoam control, automatic pH control, and facilities for air sterilization; Scale-up parameters in fermenters; Development of products using pilot-plant fermenter; Control of a fermenter by digital controllers interfaced with computers for continuous acquisition of online data and for process control;

INDUSTRIAL FERMENTER:

Temperature and pH control, aeration and agitation, Fermenter Accesories, Product recovery

Theory: 15 Hr **Total Hours : 15**

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REFERENCES

1 *Fermentation and Biochemical Engineering Handbook* ftp://ftp.feq.ufu.br/Luis/Books/E-Books/Engineering/Fermentation%20And%20Biochemical%20Engineering%20Handbook/14077_01a.pdf

2 James M. Lee, *Biochemical Engineering*, http://jmlee.org/ documents/ ebiochesample.pdf

3 Pauline M. Duran , *Bioprocess Engineering Principles*, Elsevier 2009

4 Shuler, M.L. and F. Kargi, *Bioprocess Engineering Basic Concepts* 2Ed, PHI Learning Pvt Ltd., 2008

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U14BTIN004 BIOETHANOL TECHNOLOGY

L	T	P	C
1	0	0	1

Objectives:

- To learn about the feedstocks, fermentation and purification of bioethanol

Course Outcomes :

After successful completion of this course, the students should be able to

CO1 : Describe the economic, social and environmental aspects of bioethanol

CO2 : Illustrate the feedstocks for bioethanol

CO3 : Demonstrate the fermentation routes for bioethanol production

CO4 : Outline the purification steps involved in bioethanol fermentation

CO5 : Understand the future prospects of bioethanol

Pre-requisite: Nil

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1							S					
CO2	M											
CO3	S			S								
CO4	S											
CO5												S

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Course Content

BIOETHANOL **5 hrs**

Introduction: Economic aspects, energy balance, main drivers; Global production: statistics, international and national directives, current and emerging status. First generation (sugars and starch), second generation (lignocelluloses), third generation(algae), feedstocks with future potential, feedstock processing, alternative routes to bioethanol

FERMENTATION AND PURIFICATION **5 hrs**

Ethanologenic microorganisms, theoretical and applied aspects, ethanol fermentation from sucrose, starch hydrolysate, lignocelluloses hydrolysate and algae hydrolysate. Distillation: Theoretical and applied aspects; Adsorption: Theoretical and applied aspects; Quality control: Quality parameters (process and product), alcohol specifications.

ENVIRONMENTAL ASPECTS AND FUTURE PROSPECTS **5 hrs**

Environmental aspects: Sustanability and climate change, energy and water conservation, co-products: generation and utilization, effluent treatment and control; Future prospects: Global trends and issues, future challenges.

Theory: 15 Hrs **Total Hours : 15 Hrs**

REFERENCES:

1 Walker, G.M., *Bioethanol: Science and technology and fuel alcohol*, , Graeme M. alker & Ventus Publishing ApS, 2010

OTHER REFERENCES:

1 www.ethanol.net

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COMMON GENERAL ELECTIVES

U14GST002	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives:

- Acquire knowledge on TQM concepts
- Acquire knowledge on quality systems
- Develop skills to use TQM tools for domain specific applications

Course Outcomes(COs)

After successful completion of this course, the students should be able to:

CO 1 : Understand quality concepts and philosophies of TQM
CO 2 :Apply TQM principles and concepts of continuous improvement
CO 3:Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
CO 4 : Understand the TQM tools as a means to improve quality
CO 5 : Remember and understand the quality systems and procedures adopted

Pre-requisite:

1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1									S			
CO2				M		M						
CO3	M	M			W						S	
CO4			M									M
CO5											M	

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

INTRODUCTION **9 hrs**

Definition of Quality, Dimensions of Quality, Quality costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing

TQM PRINCIPLES **9 hrs**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement,5S, Kaizen, Just-In-Time and TPS

STATISTICAL PROCESS CONTROL **9 hrs**

The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Concept of six sigma.

TQM TOOLS **9 hrs**

Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

QUALITY SYSTEMS **9 hrs**

Need for ISO 9000 and Other Quality Systems, ISO 9001:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 14001:2004

TOTAL: 45 HOURS

REFERENCE BOOKS:

1. Dale H.Besterfiled, “Total Quality Management”, Pearson Education

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2. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, South-Western (Thomson Learning), 2008.
3. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill
4. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford
5. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 2007.
6. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers.

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U14GST003 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	**0**	**0**	**3**

Objectives:

- To study the importance and functions of management in an organization
- To study the importance of planning and also the different types of plan
- To understand the different types of organization structure in management
- To understand the basis and importance of directing and controlling in management
- To understand to the importance of corporate governance and social responsibilities.

Course Outcomes(COs)

After successful completion of this course, the students should be able to:

CO1: Understand the concepts of management, administration and the evolution of management thoughts.

CO2: Understand and apply the planning concepts

CO3: Analyze the different organizational structures and understand the staffing process.

CO4: Analyze the various motivational and leadership theories and understand the communication and controlling processes.

CO5: Understand the various international approaches to management

Pre-requisite:

1. Nil

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CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12
CO1					W					M	S	
CO2											S	
CO3			S									
CO4									S			
CO5											M	

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	1	Course end survey
2	Assignments	2	Faculty survey
3	End semester examination	3	Industry
		4	Alumni

MANAGEMENT CONTEXT **9 hrs**

Management – Definition – Importance – Functions – Skills required for managers - Roles and functions of managers – Science and Art of Management –Management and Administration.Evolution of Classical, Behavioral and Contemporary management thoughts.

PLANNING **9 hrs**

Nature & Purpose – Steps involved in Planning – Forms of Planning – Types of plans – Plans at Individual, Department and Organization level - Managing by Objectives. Forecasting – Purpose – Steps and techniques. Decision-making – Steps in decision making.

ORGANISING **9 hrs**

Nature and Purpose of Organizing - Types of Business Organization - Formal and informal organization – Organization Chart – Structure and

Process – Strategies of Departmentation– Line and Staff authority – Benefits and Limitations. Centralization Vs De-Centralization and Delegation of Authority. Staffing – Manpower Planning – Recruitment – Selection – Placement – Induction.

DIRECTING & CONTROLLING 9 hrs

Nature & Purpose – Manager Vs. Leader - Motivation - Theories and Techniques of Motivation.

Leadership – Styles and theories of Leadership.

Communication – Process – Types – Barriers – Improving effectiveness in Communication.

Controlling – Nature – Significance – Tools and Techniques.

CONTEMPORARY ISSUES IN MANAGEMENT 9 hrs

Corporate Governance Social responsibilities – Ethics in business – Recent issues.

American approach to Management, Japanese approach to Management, Chinese approach to Management and Indian approach to Management.

TOTAL HOURS: 45

REFERENCES:

1. Tripathy PC And Reddy PN, "Principles of Management", Tata McGraw-Hill, 4th Edition, 2008.
2. Dinkar Pagare, "Principles of Management", Sultan Chand & Sons, 2000.
3. Kanagasapapathi. P (2008) Indian Models of Economy, Business and Management, Prentice Hall of India, New Delhi, ISBN: 978-81-203-3423-6.
4. G.K.Vijayaraghavan and M.Sivakumar, "Principles of Management", Lakshmi Publications, 5th Edition, 2009.
5. Harold Koontz & Heinz Weihrich, "Essentials of Management – An International perspective", 8th edition. Tata McGraw-Hill, 2009.
6. Charles W.L. Hill and Steven L McShane – Principles of Management, Tata Mc Graw-Hill, 2009.

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L	T	P	C
3	0	0	3

U14GST004 OPERATIONS RESEARCH

Objectives:

- Apply knowledge of OR techniques to domain specific industrial situations to optimize the quality of decisions
- Conduct investigations by the use of OR techniques

Course Outcomes(COs)

After successful completion of this course, the students should be able to:

CO1: Apply linear programming model and assignment model to domain specific situations

CO2: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results

CO3: Apply the concepts of PERT and CPM for decision making and optimally managing projects

CO4: Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

CO5: Analyze the inventory and queuing theories and apply them in domain specific situations.

Pre-requisite:

1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	S	S	M								
CO2	S	S	S	S								
CO3	S	S	M	M								
CO4	S	M	S	M								
CO5	S	S	S	M								

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

LINEAR MODEL 9 hrs

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex.

TRANSPORTATION AND ASSIGNMENT MODELS 9 hrs

Transportation model – Initial solution by North West corner method – least cost method – VAM. Optimality test – MODI method and stepping stone method.

Assignment model – formulation – balanced and unbalanced assignment problems.

PROJECT MANAGEMENT BY PERT & CPM 9 hrs

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT cost.

REPLACEMENT AND SEQUENCING MODELS 9 hrs

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).

Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem.

INVENTORY AND QUEUING THEORY 9 hrs

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.

Queuing system and its structure – Kendall's notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m

TOTAL HOURS: 45

REFERENCE BOOKS:

1. Taha H.A., "Operation Research", Pearson Education
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2002
3. Hira and Gupta "Problems in Operations Research", S.Chand and Co.2008
4. Wagner, "Operations Research", Prentice Hall of India, 2000
5. S.Bhaskar, "Operations Research", Anuradha Agencies, Second Edition, 2004

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U14GST005	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives:

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

Course Outcomes(COs)

After successful completion of this course, the students should be able to:

CO1: Evaluate the economic theories, Cost concepts and pricing policies

CO2: Understand the market structures and integration concepts

CO3: Understand the measures of national income, the functions of banks and concepts of globalization

CO4: Apply the concepts of financial management for project appraisal

CO5: Understand accounting systems and analyze financial statements using ratio analysis

Pre-requisite:

1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1				M						M		
CO2						W						
CO3	S											
CO4		S										
CO5				S						M		

Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

ECONOMICS, COST AND PRICING CONCEPTS 9

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods

CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT 9

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

CONCEPTS OF FINANCIAL MANAGEMENT 9

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

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ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

Total Hours: 45

REFERENCE BOOKS:

1. Prasanna Chandra, " Financial Management (Theory & Practice) TMH
2. Weston & Brigham, " Essentials of Managerial Finance"
3. Pandey, I. M., "Financial Management"
4. Fundamentals of Financial Management- James C. Van Horne.
5. Financial Management & Policy -James C. Van Horne
6. Management Accounting & Financial Management- M. Y. Khan & P. K. Jain
7. Management Accounting Principles & Practice -P. Saravanavel

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U14GST006	PRODUCT DESIGN AND DEVELOPMENT

L	T	P	C
3	0	0	3

Objectives:

- Acquire knowledge on the various stages of a product development process
- Develop skills for using the various tools and techniques for developing products
- Acquire knowledge on project management techniques

Course Outcomes(COs)

After successful completion of this course, the students should be able to:

CO1: Understand the process to plan and develop products

CO2: Understand the process of collecting information and developing product specifications

CO3: Understand the concept generation, selection and testing processes

CO4: Understand the concepts of product architecture, industrial design and design for manufacture

CO5: Understand the basics of prototyping, economic analysis and project planning and execution processes

Pre-requisite:

1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1			M								S	
CO2			M								M	
CO3			S									
CO4			M									
CO5			S						M	M	S	

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Course Assessment methods:

Direct		Indirect	
1	Internal Tests	**1**	Course end survey
2	Assignments	**2**	Faculty survey
3	End semester examination	**3**	Industry
		4	Alumni

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING 9

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.

A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization.

The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS 9

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process.

Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING 9

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process.

Overview of methodology, concept screening, concept scoring, caveats.

Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING 9

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design.

Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS 9

Prototyping basics, principles of prototyping, technologies, planning for prototypes.

Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

TOTAL: 45 HOURS

REFERENCE BOOKS:

1. Product Design and Development: Karl. T. Ulrich, Steven D Eppinger,. Irwin McGrawHill.
2. Product Design and Manufacturing: A C Chitale and R C Gupta, PHI
3. New Product Development: Timjones. Butterworth Heinmann,, Oxford. UCI.
4. Product Design for Manufacture and Assembly: Geoffery Boothroyd, Peter Dewhurst and Winston Knight.

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