

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

**CURRICULUM AND SYLLABUS**  
**(REGULATIONS 2013)**



**1<sup>st</sup> - 8<sup>th</sup> Semesters**

**B.E. MECHATRONICS ENGINEERING**



**KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE 641 049**  
**(An Autonomous Institution to Anna University, Chennai)**

**Regulations - 2013**

**B.E. MECHATRONICS ENGINEERING**

**CURRICULUM AND SYLLABI**

**SEMESTER – I**

**(COMMON TO ALL BRANCHES OF ENGINEERING & TECHNOLOGY)**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13ENT101	Technical English	2	1	0	3
U13MAT101	Engineering Mathematics – I	3	1	0	4
U13PH101	Engineering Physics	3	0	0	3
U13CH101	Engineering Chemistry	3	0	0	3
U13ME101	Engineering Graphics	2	0	3	3
U13CST101	Structured Programming using ‘C’	3	1	0	4
<b>PRACTICAL</b>					
U13PHP101/ U13CHP101	Physics Laboratory / Chemistry laboratory*	0	0	3	1
U13MEP101	Engineering Practices Laboratory	0	0	3	1
U13CSP101	Structured Programming Laboratory using ‘C’	0	0	3	1
U13GHP101	Human Excellence - Personal Values – I	0	0	1	1

**TOTAL – 32 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.

<b>SEMESTER</b>	<b>AE, CE, CSE, IT, ME, MCE</b>	<b>AU, BIO, EEE, ECE, EIE, FT, TXT</b>
First semester	U13PHP101- PHYSICS LAB	U13CHP101 - CHEMISTRY LAB
Second semester	U13CHP201- CHEMISTRY LAB (Except CSE Branch)	U13PHP 201 - PHYSICS LAB



**SEMESTER – II**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13ENT201	Professional English	1	0	2	2
U13MAT201	Engineering Mathematics – II	3	1	0	4
U13PH7202	Materials Science	3	0	0	3
U13CH7202	Applied Chemistry	3	0	0	3
U13MET201	Engineering Mechanics	3	1	0	4
U13MCT201	Electronic Devices and Circuits	3	0	0	3
<b>PRACTICAL</b>					
U13CHP201	Chemistry Laboratory	0	0	3	1
U13CSP211	Computing Laboratory	0	0	3	1
U13ECP207	Electronic Devices and Circuits Laboratory	0	0	3	1
U13GHP201	Human Excellence - Personal Values – II	0	0	2	1

**TOTAL – 31 HOURS****TOTAL CREDIT – 23****SEMESTER – III**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13MAT 301	Numerical Methods	3	1	0	4
U13MCT 301	Sensors and Data Acquisition	3	0	0	3
U13MCT 302	Kinematics of Machinery	3	1	0	4
U13MCT 303	Electrical Machines and Drives	3	0	0	3
U13MCT 304	Mechanics of Fluids for Mechatronics	3	1	0	4
U13MCT 306	Manufacturing Technology	3	0	0	3
<b>PRACTICAL</b>					
U13CEP 312	Fluid Mechanics and Machinery Laboratory	0	0	3	1
U13EEP 312	Electrical Machines Laboratory	0	0	3	1
U13MCP301	Sensors and Data Acquisition Laboratory	0	0	3	1
U13GHP 301	Human Excellence - Family Values	1	0	1	1

**Total periods – 32****Total credits – 25**


**SEMESTER – IV**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13MAT402	Signals and systems	3	1	0	4
U13GST 001	Environmental Science and Engineering	3	0	0	3
U13MCT 401	Industrial Electronics	3	0	0	3
U13 MCT 402	Mechanics of Solids for Mechatronics	3	1	0	4
U13 MCT 403	Dynamics of Machinery	3	1	0	4
U13MCT 405	Digital Electronics	3	1	0	4
<b>PRACTICAL</b>					
U13MEP 404	Machine Dynamics Laboratory	0	0	3	1
U13EEP 411	Industrial Electronics Laboratory	0	0	3	1
U13MEP403	Manufacturing Technology Laboratory	0	0	3	1
U13GHP 401	Human Excellence - Professional Value	1	0	1	1

**Total periods – 33****Total credits - 26****SEMESTER – V**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13ECT512	Digital Signal Processing	3	1	0	4
U13MCT 501	Microprocessor and Microcontroller	3	0	0	3
U13MCT 502	Control Engineering	3	1	0	4
U13MCT 503	CNC Technology	3	0	0	3
U13MCT 504	Process Control and Instrumentation	3	0	0	3
U13MCT 505	Design of Machine Elements	3	1	0	4
<b>PRACTICAL</b>					
U13MCP 501	Instrumentation Laboratory	0	0	3	1
U13MCP 502	CAD/CAM Laboratory	0	0	3	1
U13MCP 503	Microprocessor Microcontroller Laboratory	0	0	3	1
U13GHP 501	Human Excellence-Social Values	1	0	1	1

**Total periods – 32****Total credits - 25**


**SEMESTER-VI**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13MCT 601	Design of Mechatronics System	3	0	0	3
U13MCT 602	Applied Hydraulics and Pneumatics	3	0	0	3
U13MCT 603	Programmable Logic Controller	3	0	0	3
U13MET 604	Thermodynamics and Heat Transfer	3	1	0	4
U13MCT 604	Embedded System Design	3	0	0	3
E1*	Elective-I	3	0	0	3
<b>PRACTICAL</b>					
U13MCP 601	Hydraulics and Pneumatics Laboratory	0	0	3	1
U13MCP 602	Embedded System Design Laboratory	0	0	3	1
U13ENP601	Communication Skill Laboratory	0	0	3	1
U13MCP 603	Mini Project 1	0	0	0	1
U13GHP 601	Human Excellence-National Values	1	0	1	1

**Total periods – 30****Total credits - 24****SEMESTER-VII**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
U13MCT 701	Robotics and Machine Vision System	3	0	0	3
U13MCT 702	Automotive Electronics	3	0	0	3
U13MCT 703	Micro Electro Mechanical systems	3	0	0	3
U13GST 008	Professional Ethics	3	0	0	3
E2**	Elective-II	3	0	0	3
E3***	Elective-III	3	0	0	3
<b>PRACTICAL</b>					
U13MCP 701	Robotics Laboratory	0	0	3	1
U13MCP 702	Process Control and Simulation Laboratory	0	0	3	1
U13MCP 704	Mini Project 2	0	0	4	2
U13GHP 701	Human Excellence-Global Values	1	0	1	1

**Total periods – 30****Total credits - 23****SEMESTER-VIII**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
E4****	Elective-IV	3	0	0	3
E5*****	Elective-V	3	0	0	3
E6*****	Elective-VI	3	0	0	3
<b>PRACTICAL</b>					
U13MCP801	Project Work	0	0	18	6

**Total periods – 27****Total credits - 15**


LIST OF ELECTIVES  
ELECTIVES FOR SEMSTER VI  
\*ELECTIVE I

Code No	Course Title	L	T	P	C
U13GST 004	Operations Research	3	0	0	3
U13MCE 101	Finite Element Analysis (FEA)	3	0	0	3
U13GST 005	Engineering Economics and Financial Management	3	0	0	3
U13MCE 102	Plant Layout and Material Handling	3	0	0	3

ELECTIVES FOR SEMSTER VII  
\*\*ELECTIVE II & \*\*\*ELECTIVE III

Code No	Course Title	L	T	P	C
U13MCE 201	Modeling and Simulation	3	0	0	3
U13MCE 202	Production Planning Control	3	0	0	3
U13GST 006	Product Design and Development	3	0	0	3
U13MCE 203	Digital Image Processing	3	0	0	3
U13MCE 204	Statistical Quality Control	3	0	0	3
U13MCE 205	Virtual Instrumentation	3	0	0	3
U13MAE 702	Probability and Applied Statistics	3	0	0	3
U13MCE 206	Computational Fluid Dynamics (CFDs)	3	0	0	3
U13MCE 207	Computer Networks	3	0	0	3
U13MCE 208	Maintenance Engineering	3	0	0	3
U13MCE 209	Sensors for Engineering Applications	3	0	0	3
U13MCE 210	Concepts of Engineering Design	3	0	0	3



ELECTIVES FOR SEMSTER VIII  
ELECTIVES FOR IV, V&VI

Code No	Course Title	L	T	P	C
U13MCE 301	Rapid Prototyping	3	0	0	3
U13MCE 302	Renewable Energy Sources	3	0	0	3
U13MCE 303	Medical Mechatronics	3	0	0	3
U13MCE 304	Intellectual Property Rights (IPR)	3	0	0	3
U13MCE 305	Artificial Intelligence	3	0	0	3
U13MCE 306	Automation System Design	3	0	0	3
U13MCE 307	Nano Science	3	0	0	3
U13MCE 308	Introduction to Aircraft Engineering	3	0	0	3
U13MCE 309	Vehicle Dynamics and control	3	0	0	3
U13MCE 310	Non destructive Evaluation	3	0	0	3
U13MCE 311	Engineering Metrology	3	0	0	3
U13GST 002	Total Quality Management	3	0	0	3



# SEMESTER I

24 May



<b>U13ENT101</b>	<b>U13ENT101/ TECHNICAL ENGLISH (Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course OBJECTIVES

- To offer exposure to the extensive usage of Technical English with special reference to corporate world communication
- To embark on systematic, syntactic and semantic proficiency of Technically used English
- To embellish the usage of English to exhibit engineering and technical concepts.
- To improvise the quality of Written Technical English.
- To develop the competency level of professional writing with a keen focus to corporate situations

<b>UNIT - I FUNDAMENTALS OF TECHNICAL ENGLISH</b>	<b>9 Hours</b>
<b>Periods</b> Glimpses of Technical English – Systematic nuances of Technical English – Parts of Speech - Word Formation using Affixation – Vocabulary (synonyms and one word substitutes) – Tenses – Concord – Note making- Paragraph writing – Discourse markers – Sequencing of jumbled sentences.	
<b>UNIT - II GRAMMAR IN TECHNICAL ENGLISH</b>	<b>9 Hours</b>
Editing (Grammar - Articles, Parts of Speech, Punctuation and Spelling Rules) – Reading Comprehension – Application of Conditional Sentences.	
<b>UNIT - III TECHNICAL EXPRESSIONS</b>	<b>9 Hours</b>
Abbreviations and Acronyms – Expressions of Purpose and Function (Devices, Theories & Hypotheses) – Letter for practical training- Industrial visit – Interrogatives (‘Wh’ questions, Verbal Questions & Question Tags) – Reporting an incident / accident	
<b>UNIT - IV DRAFTING TECHNICAL DETAILS</b>	<b>9 Hours</b>
Usage of Discourse Markers – Comparative Adjectives – Transcoding Graphics into continuous writing and text into graphics – Bar chart / Pie chart / Flow chart / Line graph / Tabulated data / Tree diagram or Organizational chart into text – E-mail Etiquette and its professional application.	
<b>UNIT - V APPLICATIONS OF TECHNICAL ENGLISH</b>	<b>9 Hours</b>
Definitions – Impersonal passive structures – Describing a technical process – Writing instructions – Making suggestions – Writing formal letters (Leave Letters, Apology letters, applying for bank loans, Bona-fide certificate/ mark list, Joining report, Letters of complaint).	
<b>Total: 45 Hours</b>	
<b>TEXT BOOKS</b>	
1. Rizvi Ashraf M., Effective Technical Communication, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2008.	
<b>REFERENCE BOOKS</b>	
1. Dhanavel S.P., English and Communication Skills for Students of Science and Engineering, Chennai, Orient Blackswan, 2009. 2. Devadoss K. and Malathy P., Fundamentals and Usage of Technical English, National Book Publishers, Chennai, 2013.	

<b>U13MAT101</b>	<b>U13MAT101/ENGINEERING MATHEMATICS - I</b> (Common to all branches of Engineering and Technology)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### Course 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 understand the concepts of partial differentiation, maxima and minima.
- To solve ordinary differential equations of first and higher order of certain types and its applications

#### UNIT - I MATRICES

**9 Hours**

Rank of a matrix – Linearly dependent and independent vectors – Eigen values and eigen vectors of a real matrix – Properties of eigen values and eigen vectors – 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.

#### UNIT - II 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.

#### UNIT - III 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. (Differential equation and associated conditions need to be given).

#### UNIT - IV 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 equation and associated conditions need to be given).

#### UNIT - V 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 constraint – Jacobians.

**Total: 45 Hours**

#### TEXT BOOKS

Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40<sup>th</sup> Edition. .

#### REFERENCE BOOKS

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

<b>U13PH7101</b>	<b>U13PH7101/ ENGINEERING PHYSICS (Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **AIM**

- To enhance student knowledge of theoretical and modern technological aspects in physics.
- To enable the students to correlate the theoretical principles with application oriented studies.
- To introduce fundamentals of science for engineering applications.

#### **Course 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.

<b>UNIT - I CRYSTAL PHYSICS</b>	<b>9 Hours</b>
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.	
<b>UNIT - II APPLIED OPTICS</b>	<b>9 Hours</b>
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 <sub>2</sub> 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.	
<b>UNIT - III QUANTUM PHYSICS</b>	<b>9 Hours</b>
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.	
<b>UNIT - IV ULTRASONICS AND NDT</b>	<b>9 Hours</b>
Introduction – production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezo electric generator –properties –detection – cavitation –acoustic grating – velocity measurement – applications –Sonar –velocity of blood flow – NDT –Liquid Penetrant method – Ultrasonic flaw detector – A scan, B scan, C scan – X- ray radiography and fluoroscopy – Thermography	
<b>UNIT - V ATOMIC AND NUCLEAR PHYSICS</b>	<b>9 Hours</b>

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**

**TEXT BOOKS**

1. Gaur R.K. and Gupta S.L., Engineering Physics, 8<sup>th</sup> edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003. (Units: 1,2,3,4,5).

**REFERENCE BOOKS**

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. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005.



U13CH7101/	U13CH7101/ ENGINEERING CHEMISTRY (Common to all branches of Engineering and Technology)	L	T	P	C
		3	0	0	3

## OBJECTIVES

On completion of the course, the students are expected

- 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

### UNIT - I 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

### UNIT - II ENERGY STORING DEVICES

9 Hours

**Batteries :** Primary Battery (Leclanche & 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

### UNIT - III 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)

### UNIT - IV 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)

### UNIT - V 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**

**TEXT BOOKS**

1. Jain P.C. and Monika Jain, Engineering chemistry, Dhanpatrai Pub. Co. (P) Ltd., New Delhi. (Unit 1 to 4)
2. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical chemistry, Shoban Lal Nagin Chand & Co., New Delhi (unit 1, 3 to 5)

**REFERENCE BOOKS**

1. Bahl B.S., Tuli G.D. and Arun Bahl., 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.

**COURSE OUTCOMES**

- Understand the basic concepts of electrochemistry and assemble a battery
- explain the phenomenon of production of electric current and generation of nuclear energy
- Discuss the thermodynamic concepts and the feasibility of chemical reaction
- Describe the theory of adsorption and its applications
- Outline the principles and instrumentation of spectroscopic techniques



<b>U13ME7101</b>	<b>U13ME7101/ ENGINEERING GRAPHICS (Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>3</b>	<b>3</b>

### Course 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.

<b>UNIT - I PLANE CURVES, PROJECTION OF POINTS AND LINES</b>	<b>15 Hours</b>
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.	
<b>UNIT - II PROJECTIONS OF SURFACES AND SOLIDS</b>	<b>15 Hours</b>
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.	
<b>UNIT - III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES</b>	<b>15 Hours</b>
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.	
<b>UNIT - IV PICTORIAL PROJECTIONS</b>	<b>15 Hours</b>
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.	
<b>UNIT - V FREE-HAND SKETCHING</b>	<b>15 Hours</b>
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.	
<b>L: 30, P: 45, TOTAL: 75 Hours</b>	
<b>TEXT BOOKS</b>	
<ol style="list-style-type: none"> <li>1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.</li> <li>2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.</li> </ol>	
<b>REFERENCE BOOKS</b>	
<ol style="list-style-type: none"> <li>1. Natarajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.</li> <li>2. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.</li> <li>3. Gopalakrishna K.R., Engineering Drawing (Vol. I &amp; II), Subhas Publications, 2001.</li> </ol>	



<b>U13CS7101</b>	<b>U13CS7101/ STRUCTURED PROGRAMMING USING C (Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### Course 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

<b>UNIT - I INTRODUCTION</b>	<b>9 Hours</b>
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.	
<b>UNIT - II C LANGUAGE BASICS</b>	<b>9 Hours</b>
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.	
<b>UNIT - III ARRAYS AND STRINGS</b>	<b>9 Hours</b>
Arrays – Initialization – Declaration – One Dimensional And Two Dimensional Arrays. String- String Operations – String Arrays. Simple Programs- Sorting- Searching – Matrix Operations.	
<b>UNIT - IV FUNCTIONS AND POINTERS</b>	<b>9 Hours</b>
<b>Functions:</b> Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion. <b>Storage classes</b> – auto, static, extern, register- scope rules. <b>Pointers:</b> Definition – Initialization – Pointers arithmetic – Pointers and arrays- Dynamic memory allocation - Example Problems	
<b>UNIT - V STRUCTURES AND UNIONS AND FILES</b>	<b>9 Hours</b>
<b>Structures and Unions:</b> Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions.  <b>Files:</b> Introduction – Using files in C- Working with text files.	
<b>L: 45, T: 15, TOTAL: 60 Hours</b>	
<b>TEXT BOOKS</b>	
<b>1.</b> Pradip Dey and Manas Ghosh, Programming in C, Second Edition, Oxford University Press, 2011.	
<b>REFERENCE BOOKS</b>	
1. Rajasekaran S., Numerical methods in Science and Engineering-A practical approach, S. Chand and Company, New Delhi, 2012. 2. Kernighan B.W. and Ritchie D.M., The C Programming language, Second Edition, Pearson Education, 2006. 3. Byron S. Gottfried and Jitendar Kumar Chhabra, Programming with C, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.	



4. Ashok N. Kamthane, Computer programming, Pearson Education, 2007.

U13PHP101	U13PHP101/ U13PHP201 PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	L	T	P	C
		0	0	3	1

### **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**



U13CHP101/ U13CHP201	U13CHP101/ U13CHP201 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  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$ .
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 of Quantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-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
- Estimate the concentration of solutions by electrochemical methods

U13MEP101	<b>U13MEP101/ ENGINEERING PRACTICES LABORATORY</b> <b>(Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>

### **LIST OF EXPERIMENTS**

<b>GROUP – I</b>	
<b>A. CIVIL ENGINEERING</b>	<b>21 Hours</b>
<b>1. Carpentry</b>	
<ul style="list-style-type: none"> <li>• Study of carpentry tools</li> <li>• Preparation of T joint</li> <li>• Preparation of dovetail joint</li> </ul>	
<b>2. Plumbing</b>	
<ul style="list-style-type: none"> <li>• Study of pipeline joints</li> </ul>	
<b>B. MECHANICAL ENGINEERING</b>	
<b>1. Fitting</b>	
<ul style="list-style-type: none"> <li>• Study of fitting tools</li> <li>• Preparation of L joint</li> <li>• Preparation of square joint</li> </ul>	
<b>2. Sheet Metal Working</b>	
<ul style="list-style-type: none"> <li>• Study of sheet metal working tools</li> <li>• Preparation of cone and tray</li> </ul>	
<b>3. Welding</b>	
<ul style="list-style-type: none"> <li>• Study of arc welding tools and equipment</li> <li>• Preparation of butt joint</li> </ul>	
<b>GROUP - II (ELECTRICAL &amp; ELECTRONICS ENGINEERING)</b>	
<b>C. ELECTRICAL ENGINEERING PRACTICE</b>	<b>12 Hours</b>
<ul style="list-style-type: none"> <li>• Basic household wiring using switches, fuse, indicator-lamp, etc.,</li> <li>• Preparation of wiring diagrams.</li> <li>• Stair case light wiring.</li> <li>• Tube light wiring</li> <li>• Study of iron-box, fan with regulator, emergency lamp and microwave oven.</li> </ul>	
<b>D. ELECTRONIC ENGINEERING PRACTICE</b>	<b>12 Hours</b>
1. Assembling simple electronic component on a small PCB and Testing. 2. Soldering simple electronic circuits and checking continuity. 3. Measurements using digital multimeter. <ul style="list-style-type: none"> <li>• DC and AC voltage measurement</li> <li>• DC and AC current measurements.</li> <li>• Resistance Measurement.</li> </ul>	

- 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**



U13CSP101	<b>U13CSP101/ STRUCTURED PROGRAMMING LABORATORY USING C</b> <b>(Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>

<b>OBJECTIVES</b>	
<ul style="list-style-type: none"> <li>To enable students to solve problems using C</li> <li>To apply the various features of C</li> </ul>	
<b><u>LIST OF EXPERIMENTS</u></b>	
<ol style="list-style-type: none"> <li>Simple programs <ul style="list-style-type: none"> <li>To find whether the given number is prime or not</li> <li>Factorial of the given number</li> </ul> </li> <li>Programs involving Control and Looping Structures <ul style="list-style-type: none"> <li>Arithmetic Progression</li> <li>Trigonometric series evaluation</li> </ul> </li> <li>Programs using Arrays <ul style="list-style-type: none"> <li>Sorting</li> <li>Matrix addition and Multiplication</li> </ul> </li> <li>Calculation of median of a frequency distribution.</li> <li>Evaluation of integrals <ul style="list-style-type: none"> <li>Trapezoidal Rule</li> </ul> </li> <li>String Processing</li> <li>Program using Recursive function</li> <li>Using pointers in C</li> <li>Program using Functions, Structures and Files <ul style="list-style-type: none"> <li>Students Mark Analysis</li> </ul> </li> <li>Iterative method for finding Roots of the polynomials <ul style="list-style-type: none"> <li>Lagrange interpolation method</li> </ul> </li> </ol>	
<b>TOTAL: 45 HOURS</b>	
<b>COURSE OUTCOMES</b>	
<ul style="list-style-type: none"> <li>➤ Develop skills on use of C for simple problem solving</li> <li>➤ Develop skills on the usage of C for statistical and scientific problem solving</li> <li>➤ Acquire skills on the usage of C for statistical and scientific problem solving</li> </ul>	



<b>U13GHP101</b>	<b>U13GHP101/ PERSONAL VALUES – I</b> <b>(Common to all branches of Engineering and Technology)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>

### OBJECTIVES

- To inspire students to become best Humans.
- To know about self.
- To overcome evil temperaments.
- To practice meditation & pranayamam

<b>UNIT - I LIFE &amp; HUMAN EXCELLENCE</b>	<b>3 Hours</b>
<b>Human Excellence:</b> Introduction – objective – personal values - importance. <b>Life</b> : Self – Society – Nature – yoga – purpose of life – philosophy of life.	
<b>UNIT - II BODY, SOUL, MIND &amp; THEIR FUNCTIONAL RELATIONSHIP</b>	<b>3 Hours</b>
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.	
<b>UNIT - III SELF INTROSPECTION</b>	<b>3 Hours</b>
Introduction – Importance – Blemishes – Six evil temperaments & their maneuvering.	
<b>UNIT - IV THOUGHT ANALYSIS</b>	<b>3 Hours</b>
Introduction of Thought; process of thought – Mind & Thought relationship – causes for origin of Thoughts; Exercise : Training & Practice of Thought analysis	
<b>UNIT - V MEDITATION AND PRANAYAMAM - THEORY WITH PRACTICAL SESSION</b>	<b>3 Hours</b>
<b>Meditation :</b> Introduction to Meditation <b>Pranayamam:</b> Importance of Naadisudhi, Thanduvadasudhi (Clearance practice), Kabhalabathi and their practice.	
<b>Total: 15 Hours</b>	



# SEMESTER II

24 May

U13ENT201	<b>U13ENT201/ PROFESSIONAL ENGLISH</b> (Common to all branches of Engineering and Technology)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Course OBJECTIVES

- To enhance application oriented usage of English language
- To inculcate essential language proficiency through a good combination of practical and theoretical exposure
- To widen the area of creative writing skill of the students
- To initiate the students to make use of English to exhibit their professionalism
- To enable the students with adequate language exposure to business, professional and corporate facets of life.

<b>UNIT - I RUBRICS OF PUBLIC SPEAKING</b>	<b>9 Hours</b>
Vocabulary (Antonyms) – Homonyms- Use of Compound Prepositions – Public address (compering /welcoming / proposing vote of thanks) -- Creating Advertisements.	
<b>UNIT - II ESSENTIAL REQUISITES OF PROFESSIONAL ENGLISH</b>	<b>9 Hours</b>
Compound Nouns – Gerunds and Infinitives – Workplace Idioms – Reported Speech– Preparing a Check list- Composing Statement of Purpose (SOP) - Preparing a Resume with Cover letter.	
<b>UNIT - III CORPORATE CORRESPONDENCE</b>	<b>9 Hours</b>
Usage of Cause and Effect Expressions – Collocation - Business Letters (quotation, order and complaint) – Composing a letter of resignation- recommendations – Composing e-Mail – Reading for information / global understanding- Writing Notices and Circulars.	
<b>UNIT - IV NUANCES OF ENGLISH</b>	<b>9 Hours</b>
American Vs British English – Contractions – Types of Conversations – Assertive, Persuasive Conversations – Telephonic Conversations – Greetings – Pronunciation tips – Reviewing books / articles.	
<b>UNIT - V SENSITIZING LANGUAGE SKILLS</b>	<b>9 Hours</b>
Picture perception – Importance of Body Language in presentation – Strategic usage of Power Point Presentations – Essay writing.	
<b>Total: 45 Hours</b>	
<b>REFERENCE BOOKS</b>	
1. Krishnaswamy N., Sri Raman T. Creative English for Communication, MacMillan Pub, Chennai, 2009.	
2. Devadoss K. and Malathy P., Interfacing with Corporate, National Book Publishers, Chennai, 2013.	



U13MAT201	U13MAT201/ ENGINEERING MATHEMATICS – II (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 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.

<b>UNIT - I</b>	<b>MULTIPLE INTEGRALS</b>	<b>9 Hours</b>
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 .		
<b>UNIT - II</b>	<b>VECTOR CALCULUS</b>	<b>9 Hours</b>
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.		
<b>UNIT - III</b>	<b>ANALYTIC FUNCTION</b>	<b>9 Hours</b>
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.		
<b>UNIT - IV</b>	<b>COMPLEX INTEGRATION</b>	<b>9 Hours</b>
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).		
<b>UNIT - V</b>	<b>LAPLACE TRANSFORM</b>	<b>9 Hours</b>
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		
<b>L: 45, T: 15, TOTAL: 60 Hours</b>		
<b>TEXT BOOKS</b>		

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42<sup>nd</sup> Edition, 2012. (for Units I to IV).

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)

#### **REFERENCE BOOKS**

1. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10<sup>th</sup> Edition, 2010.
2. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
3. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
4. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
5. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.



U13PH7202	U13PHT202/ MATERIALS SCIENCE (Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	L	T	P	C
		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.

<b>UNIT - I CONDUCTING AND SUPERCONDUCTING MATERIALS</b>	<b>9 Hours</b>
<p><b>Conducting Materials :</b> 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.</p> <p><b>Superconducting Materials :</b> Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &amp;Type II superconductors – High T<sub>c</sub> superconductors - Applications – cryotron, magnetic levitation and squids.</p>	
<b>UNIT - II SEMICONDUCTING MATERIALS</b>	<b>9 Hours</b>
<p>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.</p>	
<b>UNIT - III MAGNETIC &amp; DIELECTRIC MATERIALS</b>	<b>9 Hours</b>
<p><b>Magnetic Materials :</b> 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.</p> <p><b>Dielectric Materials :</b> 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.</p>	
<b>UNIT - IV NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS</b>	<b>9 Hours</b>
<p><b>New Engineering Materials :</b> Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.</p> <p><b>Nano Materials :</b> synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparticles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties &amp; applications.</p>	

<b>UNIT - V      STRENGTHENING OF MATERIALS</b>	<b>9 Hours</b>
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.	
<b>Total: 45 Hours</b>	
<b>TEXT BOOKS</b>	
<ol style="list-style-type: none"> <li>1. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand &amp; Company Ltd, New Delhi, 2005, (Units: 1,2,3).</li> <li>2. Rajendran V. and Marikani A., Materials science, 5<sup>th</sup> edition, Tata Mc-Graw-Hill publishing company Ltd, 2004, (Units: 4).</li> <li>3. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005, (Units: 5).</li> </ol>	
<b>REFERENCE BOOKS</b>	
<ol style="list-style-type: none"> <li>1. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.</li> <li>2. Pillai S.O., Solid State Physics, 5<sup>th</sup> edition, New Age International Publication, New Delhi, 2003.</li> </ol>	



U13CH7202	<b>U13CH7202/ APPLIED CHEMISTRY</b> (Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course OBJECTIVES

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

### Course Outcomes

<b>UNIT - I FUELS</b>	<b>9 Hours</b>
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).  <b>Combustion :</b> gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).	
<b>UNIT - II MECHANICAL ENGINEERING MATERIALS</b>	<b>9 Hours</b>
<b>Abrasives:</b> Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).  <b>Refractories:</b> 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.  <b>Lubricants:</b> 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).	
<b>UNIT - III CORROSION SCIENCE</b>	<b>9 Hours</b>
<b>Corrosion</b> - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.  <b>Types of corrosion:</b> galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.  <b>Corrosion control:</b> cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).	
<b>UNIT - IV WATER TECHNOLOGY</b>	<b>9 Hours</b>
<b>Boiler feed water:</b> requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion). <b>Prevention of scale formation:</b> external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water	

<b>UNIT - V      PHASE RULE</b>	<b>9 Hours</b>
Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: one component system (Fe system only) - simple eutectic system (Ag-Pb system only).	
<b>POWDER METALLURGY</b>	
Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.	
<b>Total: 45 Hours</b>	
<b>TEXT BOOKS</b>	
1. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi (Unit3, 4, 5). 2. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi (Unit 1, 2, 5).	
<b>REFERENCE BOOKS</b>	
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.	
<b>COURSE OUTCOMES</b>	
➤ Classify the different types of fuels and their properties ➤ Categorize the engineering materials and their uses ➤ Defend the Corrosion problems ➤ Design a water purifier ➤ Explain the concept of phase rule and powder metallurgy	

U13ME7201	U13ME7201/ ENGINEERING MECHANICS (Common to CE, AUE, AE, ME, MCE & TXT)	L	T	P	C
		3	1	0	4

### Course 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.

<b>UNIT - I BASICS &amp; STATICS OF PARTICLES</b>	<b>9 Hours</b>
Introduction - Units and Dimensions - Laws of Mechanics Lamé's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.	
<b>UNIT - II EQUILIBRIUM OF RIGID BODIES</b>	<b>9 Hours</b>
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.	
<b>UNIT - III PROPERTIES OF SURFACES AND SOLIDS</b>	<b>9 Hours</b>
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.	
<b>UNIT - IV FRICTION</b>	<b>9 Hours</b>
Frictional force-Law of coulomb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.	
<b>UNIT - V DYNAMICS OF PARTICLES</b>	<b>9 Hours</b>
Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.	
Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.	
<b>L: 45, T: 15, TOTAL: 60 Hours</b>	
<b>TEXT BOOKS</b>	
1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.	
<b>REFERENCE BOOKS</b>	
1. Hibbeler, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.	
2. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.	

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





U13MCT 201	U13MCT 201/ ELECTRONIC DEVICES AND CIRCUITS (For Mechatronics Engineering)	L	T	P	C
		3	0	0	3

<b>UNIT - I CIRCUIT THEORY</b>	<b>9 Hours</b>
Network Theorems: Kirchoff's laws – Thevinin's and Norton's theorems - Superposition theorem. Two port networks: Z Parameters – Y parameters h parameters.	
<b>UNIT - II THEORY OF SEMICONDUCTOR DEVICES</b>	<b>9 Hours</b>
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.	
<b>UNIT - III APPLICATIONS OF DIODES</b>	<b>9 Hours</b>
HW and FW rectifiers – Filters with Capacitor and Inductors -Clippers and Clampers – Voltage Multipliers – Voltage regulators – Zener, series and shunt types.	
<b>UNIT – IV AMPLIFIERS AND OSCILLATORS</b>	<b>9 Hours</b>
Small signal amplifiers – h parameter model for low frequencies – Feedback amplifiers, cascading amplifiers, differential amplifier – Oscillators – Hartley and Colpitt oscillators.	
<b>UNIT - V OPERATIONAL AMPLIFIERS</b>	<b>9 Hours</b>
Ideal characteristics – Inverting, Non-inverting – summer – Comparator, Integrator, differentiator – Schmitt trigger – R.C. Phase shift oscillator, Wein Bridge Oscillator – Multivibrators.	
<b>Total: 45 Hours</b>	
<b>TEXT BOOKS</b>	
1. Sudhakar, Shyamamohan and Palli S., Circuits and Networks: Analysis & Synthesis, Tata Mc Graw Hill, New Delhi, 4 <sup>th</sup> edition, 2010 (Unit: 1). 2. Salivahanan S., Suresh kumar N. and Vallavaraj A., Electronic Devices and Circuits, Tata Mc Graw Hill publishing company, New Delhi, 2 <sup>nd</sup> edition, 2008 (Units: 2,3,4). 3. Roy Chowdhury D. and Jain Shail B., Linear Integrated Circuits, New Age Int. Pub., 4 <sup>th</sup> edition, 2010 (Unit: 5).	
<b>REFERENCE BOOKS</b>	
1. Albert Malvino and Bates J., Electronic Principles, Tata McGraw- Hill Pub. Company Ltd., 7 <sup>th</sup> edition, 2008. 2. Millman J., Halkias C.C. and Satyabrata Jit, Electronic Devices and Circuits, Tata McGraw Hill, New Delhi, 2 <sup>nd</sup> edition, 2008. 3. Thomas L. Floyd, Electronic Devices, Pearson Education Asia, 5 <sup>th</sup> edition, 2001. 4. William Hayt, Kemmerly J. and Durban S.M., Engineering Circuit Analysis, McGraw Hill Education, 2011.	

<b>U13CHP101/ U13CHP201</b>	<b>U13CHP101/ U13CHP201 CHEMISTRY LABORATORY</b> (Common to all branches of Engineering and Technology)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>

## 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

**9 Hours**

### **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  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$ .
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**

## **REFERENCE BOOKS**

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-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
- Estimate the concentration of solutions by electrochemical methods

U13CSP211/	U13CSP211/ COMPUTING LABORATORY	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>

## 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
  - Addition of two images
  - Subtraction of two images
10. Write a Matlab program for the following
  - Read an image and crop
  - Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

**TOTAL: 45 HOURS**

## COURSE OUTCOMES

- Acquire knowledge to create web pages using HTML.
- Develop skills in analyzing the usability of a website.
- Develop an attitude to embed social media content into web pages and to understand the basics of MATLAB operations.



U13ECP207	<b>U13ECP207/ ELECTRONIC DEVICES AND CIRCUITS LABORATORY</b> <i>(For Mechatronics Engineering)</i>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>

### OBJECTIVES

- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits
- To simulate electronic circuits using standard software packages

### LIST OF EXPERIMENTS

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**



U13GHEP201	U13GHEP201/ PERSONAL VALUES – II (Common to all branches of Engineering and Technology)	L	T	P	C
		1	0	1	1

### OBJECTIVE

- To inspire students to become blissful humans.
- To make the students able to come out of greed and keep mind pure.
- To outgrow the dangerous emotions.
- To achieve sound health and reach the intuition level.

<b>UNIT - I MORALIZATION OF DESIRE</b>	<b>4 Hours</b>
Introduction – Causes of desire – Types of desire – Contra qualities evolving out of desire – effect of unfulfilled desire – Renunciation – Is attainment of desire in harmony with Law of Nature.  <b>Training :</b> Moralization of Desire.	
<b>UNIT - II NEUTRALIZATION OF ANGER</b>	<b>4 Hours</b>
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.  <b>Training :</b> neutralizing anger.	
<b>UNIT - III ERADICATION OF WORRIES</b>	<b>4 Hours</b>
Worry – causes & Effects of worries – Types of problems – Solution to problems – Overcoming Worries.  <b>Training :</b> Eradication of Worries.	
<b>UNIT – IV REALIZATION OF SELF</b>	<b>4 Hours</b>
Transformation Theory – Understating Self – Guru’s role in guiding – Who am I ? – Shaping one’s destiny.  <b>Training :</b> Realization of self.	
<b>UNIT - V THEORY &amp; PRACTICAL SESSION ON MEDITATION &amp; PHYSICAL EXERCISE</b>	<b>15 Hours</b>
<p><b>Exercises:</b> Hand Exercise – Leg Exercise – Neuro muscular breathing Exercise – Kapalapathy – Magarasanas I &amp; II – Massage – Acu-pressure –Body relaxation .</p> <p><b>Meditation:</b> AgnaMeditation – ShanthiMeditation.</p>	
<b>Total: 30 Hours</b>	



# SEMESTER III

24 May

## U13MA7301 NUMERICAL METHODS FOR ENGINEERS

	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Outcomes</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**After successful completion of this course, the students should be able to**

- Solve a set of algebraic equations representing steady state models formed in engineering problems.
- Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables.
- Find the trend information from discrete data set through numerical differentiation and summarize information through numerical integration.
- Predict the system dynamic behaviour through solution of ODEs modeling the system.
- Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
- Use MATLAB for obtaining the above solutions.

### **Course Content**

#### **INTRODUCTION**

**5+3 Hours**

Simple mathematical modeling and engineering problem solving – Algorithm Design – Flow charting and pseudocode - Accuracy and precision – round off errors

#### **NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS**

**5+3 Hours**

Solution of nonlinear equations - False position method – Fixed point iteration – Newton Raphson method for a single equation and a set of non- linear equations  
Solution of linear system of equations by Gaussian elimination, Gauss Jordan method - Gauss Seidel method.

#### **CURVE FITTING AND INTERPOLATION**

**5+3 Hours**

Curve fitting – Method of least squares - Newton's forward and backward difference formulas – Divided differences – Newton's divided difference formula - Lagrange's interpolation – Inverse interpolation.

#### **NUMERICAL DIFFERENTIATION AND INTEGRATION**

**5+3 Hours**

Numerical differentiation by using Newton's forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Numerical double integration.



## **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**

**10+3 Hours**

Initial value problems - Single step methods: Taylor's series method – Truncation error – Euler and Improved Euler methods – Fourth order Runge – Kutta method – Multistep methods: Milne's predictor - corrector method.

## **NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (PDEs)**

**15+3 Hours**

PDEs and Engineering Practice – Laplace Equation derivation for steady heat conduction – Numerical solution of the above problem by finite difference schemes – Parabolic Equations from Fourier's Law of Transient Heat Conduction and their solution through implicit schemes – Method of Lines – Wave propagation through hyperbolic equations and solution by explicit method.

Use of MATLAB Programs to workout solutions for all the problems of interest in the above topics.

**Theory:45Hr**

**Tutorial:15Hr**

**Total Hours: 60**

### **REFERENCES:**

1. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers with Programming and Software Applications", Sixth Edition, WCB/McGraw-Hill, 1998.
2. John H. Mathews and Kurtis D. Fink, "Numerical Methods using Matlab", Fourth Edition, Prentice Hall of India, 2004.
3. Gerald C. F. and Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
4. Sastry S.S, "Introductory Methods of Numerical Analysis", Third Edition, Prentice – Hall of India Pvt Ltd, New Delhi, 2003.
5. Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2007.





## **U13MCT 301      SENSORS AND DATA ACQUISITION**

**L T P C**  
**3 0 0 3**

### **Course Objectives**

- To know about the types of transducers available.
- To understand the function of signal generators and analyzers.
- To gain information about data acquisition, data logging and application of sensors in condition based monitoring.

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Summarize the working and construction of sensors measuring various physical parameters.
- Design suitable signal conditioning and filter circuits for sensors.
- Outline operations of various data acquisition and transmission systems.
- Distinguish smart sensors from normal sensors by their operation and construction.
- Classify various sensing methods used in condition monitoring.

### **Course Content**

#### **SENSORS AND TRANSDUCERS**

**9 Hours**

Sensors and classifications – Characteristics environmental parameters – Selection and specification of sensors – Introduction to Acoustics and acoustic sensors- Ultrasonic sensor- Types and working of Microphones and Hydrophones – Sound level meter, Humidity sensor, and Nuclear radiation sensor – Stress- Strain measurements Strain gauges (resistive and Optical) types Uniaxial and Multiaxial strain gauges with signal conditioning circuits (half, quarter, and full bridges)

#### **SMART SENSORS**

**9Hours**

Introduction - primary sensors, characteristic, Information coding / processing, Data communication - Recent trends in sensors and Technology - Film sensor, MEMS and Nano Sensors.

#### **SIGNAL CONDITIONING**

**9 Hours**

Amplification, Filtering – Level conversion – Linearization - Buffering – Sample and Hold circuit – Quantization – Multiplexer / Demultiplexer – Analog to Digital converter – Digital to Analog converter- I/P and P/I converter - Instrumentation Amplifier-V/F and F/V converter.

#### **DATA ACQUISITION**

**9 Hours**

Data Acquisition conversion-General configuration-single channel and multichannel data acquisition – Digital filtering – Data Logging – Data conversion – Introduction to Digital Transmission system.



## SENSORS FOR CONDITION MONITORING

9 Hours

Introduction to condition monitoring - Non destructive testing (vs) condition monitoring- Intelligent fault detection- Accelerometers- Acoustic Emission sensors- Thermal imaging cameras- Vibration Signature based monitoring techniques - Acoustic emission holography - oil Analysis- Ultrasound based Non Destructive Evaluation techniques.

**Total Hours: 45**

### REFERENCES:

1. Patranabis. D, “Sensors and Transducers”, PHI, New Delhi, 2<sup>nd</sup> Edition , 2003.
2. Ernest O. Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.
3. David G. Alciatore and Michael B. Hstand, “Introduction to Mechatronics and Measurement systems”, Tata McGraw-Hill, 2<sup>nd</sup> Edition, 2008.
4. John Turner and Martyn Hill, Instrumentation for Engineers and Scientists, Oxford Science Publications, 1999.
5. Cornelius Scheffer and PareshGirdhar “Practical Machinery Vibration Analysis and Predictive Maintenance” Elsevier, 2004.
6. A.K. Sawney and PuneetSawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12<sup>th</sup> edition, DhanpatRai& Co, New Delhi, 2001.
7. Mohamed Gad-el-Hak, “The MEMS handbook”, Interpharm/CRC. 2001
8. Dr.Ing.B.V.A. RAO, “Monograph on Acoustics & Noise control”, NDRF, The Institution of Engineers (India), 2013.



**Course Objectives**

- To understand the basic mechanism and to know the layout of linkages in the assembly of a system.
- To understand the principles in displacement, velocity and acceleration at a point in a link of a mechanism
- To understand the Friction concept and its aspects.

**Course Outcomes**

**After successful completion of this course, the students will be able to**

- Design and analyze linkages, cams, gears and other mechanisms
- Apply and solve the kinematics quantities in both graphical and analytical methods.
- Distinguish various friction drives and can able to design standard frictional drives.

**Course Content****BASICS OF MECHANISMS****7+3Hours**

Terminology and Definitions - Degree of Freedom Mobility –Kutzbach criterion - Grashoff's law - Kinematic Inversions of 4-bar chain and slider crank chains - Mechanical Advantage - Transmission angle - Description of common Mechanisms - Single, double and offset slider mechanisms - Quick return mechanisms - Ratchets and escapements – Indexing Mechanisms – Rocking Mechanisms - Straight line generators – Design of Crank - rocker Mechanisms.

**KINEMATICS****12+3Hours**

Displacement, velocity and acceleration and analysis in simple mechanisms - Graphical Method velocity and acceleration polygons - Kinematic analysis - Vector Approach, Computer applications in the kinematic analysis of simple mechanisms - Coincident points – Coriolis Acceleration.

**KINEMATICS OF CAM****8+3Hours**

Classifications - Displacement diagrams - parabolic Simple harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

**GEARS****10+3Hours**

Spur gear Terminology and definitions - Fundamental Law of toothed gearing and involute gearing - Interchangeable gears - gear tooth action - Terminology - Interference and undercutting - Nonstandard gear teeth - Helical, Bevel, Worm, Rack and Pinion gears (Basic only) - Gear trains - Parallel axis gear trains - Epicyclic gear trains - Differentials.

## **FRICTION**

**8 +3 Hours**

Surface contacts-Sliding and Rolling friction - Friction drives – Friction in screw threads- Friction clutches-Belt and rope drives, Friction aspects in Brakes- Friction in vehicle propulsion and braking

**CASE STUDIES: Application of kinematics in the field of sports, forward and inverse kinematics in robotics**

**Theory:45Hr**

**Tutorial:15Hr**

**Total Hours: 60**

## **REFERENCES:**

1. Rattan S.S., „Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2009.
2. J. J. Uicker, G. R. Pennock and J. E. Shigley, „Theory of Machines and Mechanisms”, Oxford University Press, 2003.
3. Thomas Bevan, „Theory of Machines”, CBS Publishers and Distributors, 2010.
4. Ghosh A and A. K. Mallick, „Theory of Mechanisms and Machines”, Affiliated East-West Pvt. Ltd., New Delhi, 2000.
5. J.S. Rao and R.V. Duggipati, „Mechanism and Machine Theory”, Wiley-Eastern Ltd., New Delhi, 2006.
6. J. Hannah and R.C. Stephens, „Mechanics of Machines”, Viva Low-Prices Student Edition, 1999.



**Course Objectives**

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting and controlling of D.C. motors and induction motors.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- 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.

**Course Content****DC AND AC MACHINES****9 Hours**

Introduction to Magnetic Circuits - Magnetic flux - Magnetic intensity, density - Inductance : self and Mutual - Faraday's Law - Lenz's Law - Thumb rule - Fleming's Rule - Constructional details and operating principles of DC motors - Back emf - Types of motors - Speed - torque equation - Load characteristics of DC motors - Constructional details and principle of operation of three phase induction motors - Emf equation - Torque - slip characteristics - Construction and principle of operation of single phase induction motors.

**STARTING AND BREAKING METHODS****9 Hours**

Types of DC starters - Type of AC motor starters, starting methods - Breaking of electrical motors - DC motors - single phase and three phase induction motors.

**ELECTRICAL DRIVES****9 Hours**

Basic elements - Types of electrical drives - Factors influencing the choice of electrical drives - Heating and cooling curves - Loading conditions and class of duty - Selection of power rating for drive motors with regard to thermal overloading and load variation factors.

**CONVENTIONAL AND SOLID-STATE SPEED CONTROL OF DC MACHINES****9 Hours**

Speed control of DC series and Shunt motors - Armature and Field control, Ward Leonard control system - Controlled rectifiers and DC choppers based control and their applications.

**CONVENTIONAL AND SOLID-STATE SPEED CONTROL OF AC**


## **MACHINES AND INVERTER**

**9 Hours**

Speed control of three phase induction motor - Voltage control, Voltage/frequency control, slip power recovery scheme  
Inverters and AC voltage regulators: applications.

**CASE STUDIES: Pump vibration at an electrical utility. Inverter case studies for solar panel.**

**Total Hours: 45**

## **REFERENCES:**

1. Vedam Subramaniam, "Electric Drives (concepts and applications)", Tata McGraw-Hill, New Delhi, 2nd Edition, 2010.
2. Nagrath, I.J., & Kothari, D.P., "Electrical Machines", Tata McGraw-Hill, New Delhi, 3rd Edition, 2006.
3. Pillai, S.K., "A first course on Electric drives", Wiley Eastern Limited, 1998.
4. Singh, M.D. and Khanchandani, K.B., "Power Electronics", Tata McGraw-Hill, New Delhi, 1998.
5. Partab, H., "Art and Science and Utilization of electrical energy", Dhanpat Rai and Sons, New Delhi, 1994.



**Course Objectives**

- To understand the structure and the properties of the fluid.
- To understand and appreciate the complexities involved in solving the fluid flow problems.
- To understand the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.
- To understand the energy exchange process in fluid mechanics handling incompressible fluids.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Define and differentiate the various properties of fluids and flow.
- Determine the velocity, acceleration, flow rate and the frictional losses of incompressible fluids flowing through pipes.
- Identify the different types of pressure measuring devices and apply the concept of fluid statics in pressure measurements.
- Define and classify the different types of hydraulic machines and select them based on performance for real time applications.

**Course Content****BASIC CONCEPTS AND PROPERTIES****6+3Hours**

Fluid - definition, distinction between solid and fluid - Units and dimensions – Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

**FLUID KINEMATICS AND FLUID DYNAMICS****12+3Hours**

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation – flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube.

**INCOMPRESSIBLE FLUID FLOW****12+3Hours**

Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen Poiseuille equation)- Hydraulic and energy gradient - flow through pipes - Darcy - weisbach equation - pipe roughness -friction factor - Moody's diagram minor losses - flow through pipes in series and in parallel.

## HYDRAULIC TURBINES

8+3 Hours

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction. Hydro turbines: definition and classifications - Pelton turbine - Francis turbine – propeller turbine - Kaplan turbine - working principles - velocity triangles - work done – specific speed - efficiencies - performance curve for turbines.

## HYDRAULIC PUMPS

7+3Hours

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, and work saved by air vessels and performance curves - cavitations in pumps.

## CASE STUDIES

**Real time problems related to Bernouli's equation, flow between parallel plates, Pressure measurement, Flow measurement.**

**Theroy: 45Hr**

**Tuturial: 15Hr**

**TotalHours: 60**

## REFERENCES:

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (5th Edition), Laxmi publications (P) Ltd., New Delhi, 2007.
2. Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House, New Delhi, 7<sup>th</sup> Edition, 2008.
3. 3. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, 5th Edition, New Delhi, 2007.
4. Ramamirtham, S., “Fluid Mechanics and Hydraulics and Fluid Machines”, DhanpatRai and Sons, Delhi, 2006.
5. 5. Som, S.K., and Biswas, G., “Introduction to fluid mechanics and fluid machines”, Tata McGraw-Hill, 2nd Edition, 2007.





## U13 MCT 306 MANUFACTURING TECHNOLOGY

**L T P C**  
**3 0 0 3**

### Course Objectives

- To impart the knowledge on various production processes :Metal Casting. Metal Forming, Metal Machining and Metal Joining Processes.

### Course Outcomes

**After successful completion of this course, the students should be able to**

- Identify and select proper manufacturing process.
- Estimate manufacturing process time, forces and other parameters involved in various manufacturing process.
- Select appropriate joining process and parameters for different kind of materials and dimensions.
- Summaries the causes and remedies for defects occurred in manufacturing process.

### Course Content

#### **FOUNDRY TECHNOLOGY**

**9 Hours**

Pattern and Core making – Moulding sand – Melting furnaces: Cupola and Induction furnaces – Special casting processes – Shell, Investment, Die casting – Defects in casting.

#### **FORMING PROCESSES**

**9 Hours**

Hot and Cold Working Rolling - Introduction – Rolling Mills – Rolling Operations – Forging - Introduction – Related Forging Operations – Drop forging- Extrusion and Drawing - Extrusion Practice – Hot, Cold, Impact and Hydrostatic extrusion. Drawing Process – Defects and Residual Stresses – Drawing Equipment. Sheet metal operations – Blanking, Punching and Piercing. (Treatment is to be given only on operations)

#### **CONVENTIONAL MACHINING PROCESS**

**9 Hours**

Lathes and Lathe Operations, Drilling and Drilling Machines, Reaming and Reamers, Tapping and Taps – Tool nomenclature, cutting speed, feed, machining Time calculations. (No Treatment on mechanisms )

#### **SPECIALIZED MACHINING AND SUPER FINISHING PROCESS**

**9 Hours**

Milling Machines and Operations, Planning and Shaping, Broaching, Gear Hobbing and Shaping. Grinding Process – Abrasives – Finishing Operations – Lapping, Honing Burnishing. (No Treatment on mechanisms)

#### **PRINCIPLES & APPLICATIONS OF JOINING PROCESSES**

**9 Hours**

Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser – Beam Welding. Solid State Welding: Cold Welding, Ultrasonic Welding, Friction Welding, Resistance Welding and Explosive Welding. Principles and applications of Brazing and Soldering.



**CASE STUDIES:**

**Study of production processes involved in car manufacturing: Stamping – Welding –  
Painting – Assembly - Inspection**

**Total Hours:45**

**REFERENCES:**

1. Kalpakjian, S., “Manufacturing Engineering and Technology”, Pearson education India, 4th Edition, 2009.
2. HajraChoudhury, S.K., and HajraChoudhury, A.K., “Elements of Workshop Technology”, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
3. Paul Degarma E, Black J.T. and Ronald A. Kosher, Materials and Processes in Manufacturing – Hall of India, 8<sup>th</sup> Edition 2008.
4. Sharma P.C. A Textbook of Production Technology, S. Chand and Co., Ltd., 2009.



## **U13CEP312 FLUID MECHANICS AND MACHINERY LABORATORY**

**L T P C**  
**0 0 3 1**

### **Course Objectives**

- Operate fluid flow equipment and instrumentation
- To discuss and practice standard measurement techniques of fluid mechanics and their applications

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Use rotometer, venturimeter and orifice meter to determine the fluid flow parameters.
- Conduct experiments to assess the performances of various hydraulic machines.
- Analyze and present the findings of experimental observations in both written and oral format.

### **LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Roto meter.
4. Determination of friction factor of given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submersible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**Total Hours: 45**



**U13EEP 312**

**ELECTRICAL MACHINES  
LABORATORY**  
(Common to III Semester ME & MCE)

**L T P C**

**0 0 3 1**

**Course objectives**

- To expose the students to the operation of DC machines, Transformers, synchronous machines and induction motors and give them experimental skills.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Test and assess the performances of the DC motors and single phase AC motor for varying load.
- Control the speed of AC and DC motor.
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

1. Load test on DC Shunt motor
2. Load test on DC series motors
3. Speed control of DC shunt motor (Armature and Field Control)
4. Load Test on Three Phase Squirrel Cage Induction motor
5. Load Test on Single phase induction motor
6. Speed control of Three phase slip ring induction motor
7. Speed control of DC shunt motor using controlled rectifiers
8. Voltage / Frequency control of three phase induction motor using inverter.
9. Study of DC & AC starters

**Total Hours: 45**



**Course Objectives**

- To gain knowledge on data acquisition, data logging and application of sensors in condition based monitoring by conducting experiments.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Measure displacement and its derivatives by using contact and non-contact type positional sensors.
- Measure vibration and sound of various systems and can predict the causes of various frequency components from FFT.
- Design and realize various data conversion circuits and amplifiers used in data acquisition.
- Simulate simple micro systems.
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

1. Measurement of Position and velocity using encoders.
2. Measurement of Position using linear scales.
3. Measurement of speed using Inductive pickup / Proximity sensor.
4. Measurement of vibration for rotating machineries with FFT Analysis
5. Measurement of sound and estimation of noise of rotating machineries and environmental noise analysis in 1/n<sup>th</sup> and FFT analysis.
6. Design of Flash type Analog to Digital Converters.
7. Design of Digital Comparator.
8. Design of Voltage to frequency converter.
9. Design of Frequency to Voltage Converter.
10. Design of multiplexer and demultiplexer using logic gates or IC's.
11. Design of sample and hold circuit.
12. Design of instrumentation amplifier using OP-AMP.
13. Design and simulation of Micro cantilever beam
14. Design and simulation of Micropump

**Total Hours: 45**



## **U13GHP 301 HUMAN EXCELLENCES - FAMILY VALUES**

**L T P C**  
**0 0 2 1**

(Common to all branches of Engineering and Technology)

### **Course Objectives**

- To inculcate the basic need for family life and peace in it.
- To lead spiritual development through good family life.
- To respect womanhood and live disease free life.
- To live with sound health.
- To reach Intuition.

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Develop skills in maintaining harmony among the family members.
- Acquire skills in traditional yogasanas leading to sound health.
- Behave as a family member and leading to a blissful family life.
- Use food as medicine.

### **Course Content**

#### **RESTRAINT IN FAMILY**

**4 Hours**

Definition - Greatness of life force & mind. Introduction - Kayakalpa yoga -aim - maintaining youthfulness – sex & spirituality – ten stage of mind – mental frequency-method of concentration – kayakalpa philosophy - physical body – sexual vital fluid – life force – bio-magnetism - mind –food transformation into seven minerals – postponing the ageing process – death – importance of kayakalpa training.

#### **SPIRITUAL DEVELOPMENT THROUGH GOOD FAMILY LIFE**

**4 Hours**

Kayakalpa exercise – methods –aswinimudhra – ojus breathing – explanations – benefits – practices – Responsibility of men and women – introduction a good education – need of morality – spiritual development.Revision of previous physical exercises. Introduction – hints & caution – body massaging – accu-pressure –relaxation.

#### **PEACE IN FAMILY**

**4 Hours**

Family value – meaning – Introduction – values – benefits of blessings – effect of vibrations – make blessings a daily habit – greatness of friendship – individual & family peace – reason for misunderstanding in the family – no comment – no command – no demand – no ego – peace of mind.

#### **GREATNESS OF WOMANHOOD & FOOD IS MEDICINE**

**4 Hours**

Good–cultured behavioral patterns – love and compassion - Greatness of womanhood – Food is medicine (healthy food habits)

#### **SIMPLIFIED PHYSICAL EXERCISES**

**7 Hours**

Simplified physical exercises – Kaya Kalpa Yoga (Benefits related to the Patient, Tolerance, Sacrifice)



## **MEDITATION & YOGASANAS**

**7 Hours**

Thuriya meditation – introduction – practice – benefits. Asanas– ashtanga yoga – pathanjali maharishi –hints & cautions – posture - movement – involvement – standing asanas: thadasana – ekapathasana – chakrasana(side) – uthkatasana – trikonasana. Sittingasanas: thandasana – padmasana – vajrasana – suhasana – siddhasana – parvathasana – yogamudhra. Downward lying asanas: makkarasana – bhujangasana – salabhasana – navukasana– dhanurasana. Upward lying asanas: savasana - arthapavanamukthasana– pavanamukthasana – utthanapathasana – navasana& Surya namaskara.

**TotalHours: 30**

## **REFERENCES:**

1. VethathiriMaharishi, “Yoga for Modern Age”.
2. Swami Vivekananda, “The Man making Messages”.
3. Vethathiri Maharishi, “Manavalakalai Part- 1&2&3”
4. Vethathiriyam, “Value Education for Health & Happiness and Harmony”



# SEMESTER IV

24 May



**L T P C**  
**3 1 0 4**

**Course Objectives:**

- To identify continuous time systems and signals that interact with them
- To apply laws of physics to derive simple models for real-life dynamic systems
- To obtain system behavior through model based simulation
- To represent periodic signals using Fourier series and understand the significance of frequency spectra
- To understand Fourier Transformation of aperiodic signals and the resulting continuous spectra
- To infer linear time invariant system behavior through state space as well as frequency domain models.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Apply laws of Physics to model simple real life systems to predict its dynamic behavior
- Use Fourier analysis to identify the frequency characteristics of signals of interest
- Use time domain and frequency domain methods to understand the inherent behavior of LTI systems
- Take up advanced courses on system dynamics, digital signal processing and design of feedback control systems

**Course Content****REPRESENTATION OF SIGNALS AND SYSTEMS****3Hours**

Introduction to systems, signals and their interaction. Continuous time and discrete time signals, periodic and aperiodic signals, energy and power signals.

Representation of simple systems with examples. Linear and nonlinear systems, Systems with and without memory, Time varying and time- invariant systems

**DYNAMIC SYSTEM MODELING & SIMULATION****12Hours**

Lumped element modeling - Laws of Physics applied to Simple Mechanical Systems and RLC Electrical circuits

System State - State variables and forms of state equations. Matrix representation of state equations for linear dynamic systems – Free response and forced response

Time response from general system models through numerical integration. Use of Continuous System Simulation Tools (MATLAB)

**PERIODIC SIGNALS AND FOURIER SERIES****7Hours**

Obtaining trigonometric Fourier series – Exponential Fourier Series –Fourier Spectra – Parseval's Theorem- Linearity and time-shifting properties of Fourier series



## **FOURIER TRANSFORMS FOR APERIODIC SIGNALS**

**10Hours**

Fourier Transform(FT) pair and equations relating them – Magnitude and phase spectra from Fourier Transforms – Linearity, time scaling , time shifting, time differentiation and integration properties of FTs - Parseval's Energy Theorem – Existence condition for FT

## **ANALYSIS OF LINEAR TIME INVARIANT (LTI) SYSTEMS USING TRANSFORMS**

**13Hours**

Impulse Response of LTI system- Convolution integral – FT for convolved time signals - Transfer function of LTI system using Fourier Transform – System gain and phase responses in sinusoidal steady state – Bode plots – Applications in Communication and Control – Analog filters

**Theory : 45Hr**

**Lab: 15Hr**

**Total Hours : 60**

### **REFERENCES:**

1. MrinalMandal and AmritAsif, `Continuous and Discrete Time Signals and Systems", Cambridge University Press, 2007
2. P.D. Cha, J.J. Rosenberg & C.L. Dym, `Fundamentals of Modeling and Analyzing Engineering Systems", Cambridge University Press, 2000
3. W.Y. Yang et. al., `Signals and Systems with MATLAB", Springer, 2009
4. A.V. Oppenheim & A.S. Willsky, `Signals & Systems", PHI Learning Pvt.Ltd.,2011
5. V. Krishnaveni& A. Rajeshwari, `Signals &Systems",Wiley – India, 2012.



**U13GST 001 ENVIRONMENTAL SCIENCE AND  
ENGINEERING**  
(Common to all branches)

**L T P C**  
**3 0 0 3**

**Course Objectives**

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve biodiversity.

**Course Outcomes**

**Course Content**

**INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL  
RESOURCES 10Hours**

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 over-utilization 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 14Hours**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – 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) – 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.

**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.,

**Total Hours:45**

### **REFERENCES:**

1. Deswal.S and Deswal.A, “ A basic course in Environmental studies” DhanpatRai& Co, 2006.
2. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
3. Miller T.G. Jr., Environmental Science – Sustaining the earth, Wadsworth Publishing Co., 1993
4. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India., 2002
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, 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. Trivedi R.K and P.K.Goel “Introduction to Air pollution” Techno-science Publications. 2003,
10. Yamuna R.T“Environmental Science” Inter Publications, 2008



**Course Objectives**

- The course is intended to familiarize the Mechatronics students with major aspects of power electronics which has wide spread applications in today's industry such as power supplies, variable speed drives, transportation, robotics etc.

**Course outcomes****After successful completion of this course, the students should be able to**

- Relate the basic semiconductor physics to the properties of real devices, and able to analyze the different EMI problem in switching.
- Describe the concepts of operation of dc-dc converters in steady state in continuous and discontinuous modes and be able to analyze basic converter topologies. Identify the proper gating sequence and control circuit in operating the single phase and three phase inverter circuits.
- Analyze the performance parameter, various techniques for analysis and design of AC voltage controller and also list the various control schemes in cycloconverter.

**Course Content****POWER SEMICONDUCTOR DEVICES****9 Hours**

Classification of Power semiconductor devices, characteristics, construction, application and theory of operation of power diode, power transistor, thyristors. Device specifications and ratings, working of Diac, Triac, IGBT, GTO and other power semiconductor devices. EMI-Types of EMI problems – di/dt protection and dv/dt protection - snubbers – shielding - grounding-filtering – twisted shielding wires-soft switching and methods of solving in industrial electronics.

**PHASE CONTROLLED CONVERTERS****9 Hours**

Single phase full converters, 3 phase half converter and 3 phase full converter – inverter operation – input power factor – effect of source inductance- use of flywheel diode in controlled rectifier configurations– Thyristor triggering circuits.

**INVERTERS AND CHOPPERS****9 Hours**

Classification of inverters, Thyristor inverters, Voltage and Current Commutated inverters, PWM inverters, Principle of Chopper, Chopper classification – step up and step down Chopper - Types of regulators.

**A. C. VOLTAGE CONTROLLERS AND CYCLO-CONVERTERS** **9 Hours**

Single phase AC voltage controller – multistage sequence control – step up and step down cycloconverters – three phase to single phase and three phase cycloconverters

**INDUSTRIAL APPLICATIONS****9 Hours**

Solid-state switching circuits, Relays, Electronic Timer, Saw tooth generator, applications in Industrial process control, Motor drive applications, Electronic regulators, etc., Induction heating, Dielectric Heating.

**Total Hours:45**

**CASE STUDIES:    Usage of Power Electronics in Thermal power Management,  
Converters modeling and control.**

**REFERENCES:**

1. P S Bimbhra , “Power Electronics” Tata McGraw Hill, 2006
2. Rashid, M.H., “Power Electronics – Circuits Devices and Application” Prentice Hall International, New Delhi, 3<sup>rd</sup> Edition, 2004.
3. Dubey, G.K., Doradia, S.R., Joshi, A. and Singh, R.M., “Thyristorised Power Controllers”, Wiley Eastern Limited, 2008.
4. Joseph Vithayathil, “Power Electronics – Principle and Applications”, Tata McGraw-Hill Inc, New Delhi, 2010.
5. D. R. Patrick, S. W. Fardo, Industrial Electronics, Devices and Systems, Marcel Dekker, October 2000.
6. S. Bhattacharys , S. Chatterjee, “Industrial Electronics And Control ” Tata McGraw Hill, 2004



**Course Objectives**

- The subject of Mechanics of solids cuts broadly across all branches of engineering profession. At the end of this course, the student will have knowledge about behaviour of members subjected to various types of forces. The subject can be mastered best by solving numerous problems.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Apply and solve the concepts of stress, strain and deformation in various components
- Develop the shear force, bending moment diagram and calculate the slope and deflection for various types of beams and end conditions
- Determine the power transmitting, torque carrying capacities of the shafts with various cross sections
- Comprehend the energy absorption, deflection concepts of springs and solve the stiffness of helical springs by using appropriate guidelines and formulae.
- Learn the concepts of Finite Element Analysis and formulating FEA governing equations for simple structures

**Course Content****STRESS, STRAIN AND DEFORMATION OF SOLIDS****9+3 Hours**

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Strain – Poisson's ratio – lateral stress – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

**BEAMS – LOADS AND STRESSES****9+3 Hours**

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation long the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

**TORSION****9+3 Hours**

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Design of helical coil springs.

**BEAM DEFLECTION****9+3 Hours**

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns.

## **FINITE ELEMENT ANALYSIS FOR STRUCTURES**

**9+3 Hours**

Introduction to FEA, General procedure for finite element analysis, governing equation for finite element analysis for 2D & 3D Structures, Application of FEA for Bars, Stepped bar and Beams.

**Theory:45HrTutorial:15Hr**

**Total Hours: 60**

### **REFERENCES:**

1. Popov, E.P., "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2007.
2. Beer, F. P. and Johnston, R., "Mechanics of Materials", 3rd edition, McGraw-Hill, 2008.
3. Rajput, R. K., "A textbook of Strength of Materials", S. Chand, 2007.
4. Nash, W.A., "Theory of problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1998.
5. Kazimi, S.M.A., "Solid Mechanics", Tata McGraw-Hill Publishing Co, New Delhi, 2001.
6. Ryder, G.H., "Strength of Materials", Macmillan India Ltd., 2002.
7. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
8. Bansal, R.K., "A Text Book of Strength of Materials", Laxmi Publications, 2009.
9. Ramamrutham, S., "Strength of Materials", Dhanpal Rai, Publishing Company (P) Ltd., 2005





## U13MCT 403      DYNAMICS OF MACHINERY

**L T P C**  
**3 1 0 4**

### Course Objectives

- To understand the force-motion relationship in components subjected to External Forces.
- To understand the force-motion analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of Undesirable Vibrations.
- To understand the principles of various mechanisms used in machines.

### Course Outcomes:

**After successful completion of this course, the students should be able to**

- Calculate the force analysis of dynamic systems.
- Identify and analyze the static and dynamic balancing of rotating masses and reciprocating masses.
- Measure the effect of free and forced vibration.
- Summarise the concepts of governors and gyroscopes.

### Course Content

#### FORCE ANALYSIS

**10+3 Hours**

Rigid Body dynamics in general plane motion – Equations of motion.- Dynamic force analysis – Inertia force and Inertia torque – D'Alembert's principle – The principle of superposition – Dynamic Analysis in Reciprocating Engines – Gas Forces- Equivalent masses- Bearing loads - Crankshaft Torque- Turning moment diagrams– Flywheels– Engines shaking Forces – Cam dynamics- Unbalance, Spring Surge and Windup.

#### BALANCING

**9+3 Hours**

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi- cylinder Engines – Partial balancing in locomotive Engines- Balancing linkages – balancing machines

#### FREE VIBRATION

**10+3 Hours**

Basic features of vibratory systems - idealized models, Basic elements and lumping of parameters- Degrees of freedom- Single degree of freedom- Free vibration- Equation of motion- natural frequency- Types of Damping- Damped vibration- critical speed of simple shaft- Torsional systems: Natural frequency of two and three rotors systems.

#### FORCED VIBRATION

**6+3 Hours**

Response to periodic forcing- Harmonic Forcing- Forcing caused by unbalance- Support motion– Force transmissibility and amplitude transmissibility- Vibration isolation.

#### MECHANISM FOR CONTROL

**10+3 Hours**

Governors- Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors– Characteristics – Effect of friction – Controlling Force- other Governor mechanisms. Gyroscopes- Gyroscopic forces and Torques – Gyroscopic stabilization- Gyroscopic effects in Automobiles, ships and airplanes.

**CASE STUDY: Isolation of vibrations in Automobiles- Engine - Suspensions.**



**Thory: 45HrTutorial:15Hr**

**Total Hours: 60**

**REFERENCES:**

1. Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2<sup>nd</sup> Edition, 2007.
2. R.S. Khurmi, J.K. Gupta "Theory of machines", S. Chand & Company Ltd, New Delhi, 2003.
3. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2003.
4. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press, Pvt. Ltd., New Delhi, 2000.
5. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 2003.
6. Rao J.S. and Duggipati R.V., "Mechanism and Machine Theory", Wiley-Eastern Limited, New Delhi, 2006.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Vivalow-Priced Student Edition, 1999.
8. Sadhu Singh "Theory of Machines", Pearson Education, 2<sup>nd</sup> Edition, 2008.



**Course Objectives**

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- State the theorem and understand the different logic families of integrated circuits to use the various methods for simplification of gates.
- Design complex arithmetic and logic circuit and to evaluate its function realization using gates.
- Describe the timing problem in sequential circuits and internal structure of various flip - flops.
- Analyze and design various flip flop based state machines for asynchronous, synchronous sequential circuits and counters.
- Design the complex logic memories, programmable logic devices and test its functionality and timing.

**Course content****NUMBER SYSTEMS, DIGITAL LOGIC FAMILIES AND BOOLEAN LOGIC****9+3Hours**

Introduction to Number systems- Binary, Octal, Hexadecimal, BCD, Gray code, Excess 3 code - Binary arithmetic, 1's complements, 2's complements, and Code conversions Digital Logic Families:

TTL, CMOS, NMOS, ECL. Comparison of performance of various logic families. Boolean algebra: Basic Postulates and theorems, Switching functions, Canonical forms, Logic gates. Simplification using K-maps & QuineMcCluskey method, Implementation using logic gates.

**COMBINATIONAL CIRCUITS****9+3Hours**

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

**SEQUENTIAL CIRCUIT****9+3Hours**

General model of sequential circuits – Latch, Flip Flops, Level triggering, Edge triggering, Master slave configuration. Realization of one flip flop using other flip flop. Binary counters, Modulo-n counter- Decade - BCD counters. Ring counter, Johnson counter

## **DESIGN OF SEQUENTIAL CIRCUITS**

**9+3Hours**

Classification of sequential circuits – Moore and Mealy - Design of Asynchronous counters- state diagram- State table –State minimization –State assignment- Register – shift registers - Universal shift register – Ring counters. Hazards: Static - Dynamic

## **DIGITAL MEMORIES AND PROGRAMMABLE LOGIC DEVICES 9+3Hours**

Memories – ROM, PROM, EEPROM, RAM and Flash memories.– Programmable Logic Devices: Programmable Logic Array (PLA)- Programmable Array Logic (PAL)- Implementation of combinational logic using PROM and PLA,PAL. Introduction to FPGA.

**CASE STUDIES : Simple Logic Design: Seven Segment Display**

**Theory:45Hr Tutorial:15HrTotalHours: 60**

### **REFERENCES:**

- 1 M. Morris Mano, „Digital Design“, Prentice Hall of India Pvt. Ltd., New Delhi, 4<sup>th</sup> Edition, 2007
- 2 John .M Yarbrough, „Digital Logic Applications and Design“, Thomson- Vikas Publishing House, New Delhi, 2002.
- 3 S. Salivahanan and S. Arivazhagan, „Digital Circuits and Design“, Second Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2004
- 4 Charles H.Roth."Fundamentals of Logic Design", Thomson Publication Company, 2003.
- 5 Donald P.Leach and Albert Paul Malvino, „Digital Principles and Applications“, Tata McGraw Hill Publishing Company Limited, New Delhi, 5<sup>th</sup> Edition, 2003.
- 6 R.P.Jain, „Modern Digital Electronics“, Tata McGraw – Hill publishing company limited, New Delhi, 3<sup>rd</sup> Edition, 2003.
- 7 Thomas L. Floyd, „Digital Fundamentals“, Pearson Education, Inc, New Delhi,2003
- 8 Donald D.Givone, „Digital Principles and Design“, Tata McGraw - Hill Publishing company limited, New Delhi, 2003.



**Course objectives**

- To study the characteristics of governors.
- To do experiment on dynamic balancing of rotating masses and reciprocating masses.

**Course Outcomes****After successful completion of this course, the students should be able to**

- Relate the different characteristics of governors and verify gyroscopic relation.
- Draw the cam profile with different followers and Study of jump phenomenon..
- Identify the system response, natural frequency and resonance for free, forced, torsional vibrations and whirling of shaft.
- Experimental verification of dynamic balancing of rotating masses, reciprocating masses.
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

1. Governors - Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorized Gyroscope-Determination of Gyroscopic couple Verification of Laws.
4. Bifilar Suspension and Compound Pendulum – Determination of Moment of Inertia of Rod.
5. Turn Table – Determination of Moment of Inertia of Disc and Ring.
6. Epicyclic Gear Train Apparatus – Gear Ratio and Torques.
7. Balancing of rotating masses (Static and Dynamic Balancing)
8. Balancing of reciprocating masses.
9. A) Helical Spring – Natural Frequency of Longitudinal Vibrations  
B) Transverse Vibrations Verification of Dunkerley's Rule.
10. Rotor Systems – Natural Frequency of Torsional Vibrations.
11. A) Whirling of Shaft – Determination of Critical Speed  
B) Vibrating Table – Determination of Transmissibility Ratio.

**Total Hours: 45**

**Course Objectives**

- To understand solid state devices and power converter circuits by conducting experiments.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- realize solid state switches and its biasing circuits
- Choose proper power converter circuit with respect to load.
- Test the various solid state speed controller circuit for induction motor
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR / TRIAC phase control circuits
5. Study of half controlled & fully controller converters
6. Speed control of DC shunts motor using three phase fully controlled converter.
7. SCR single-phase cycloconverters
8. SCR series and parallel inverters
9. IGBT Chopper
10. IGBT based PWM inverter (single phase)

**Total Hours: 45**



**U13MEP403 MANUFACTURING TECHNOLOGY**  
**LABORATORY**

**L T P C**  
**0 0 3 1**

**Course Objectives**

- To do experiments in different manufacturing machines by abiding to safety norms.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Machine a part by selecting appropriate manufacturing process and abiding to safety norms.
- Use various measurement tools and techniques to confirm the production drawing.
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

**UNIT 1 LATHE PRACTICE**

- a. Plain Turning
- b. Taper Turning
- c. Thread Cutting

Estimation of machining time for the above turning processes.

**I DRILLING PRACTICE**

- a. Drilling
- b. Tapping
- c. Reaming

**II MILLING**

- a. Surface Milling
- b. Gear Cutting
- c. Contour Milling

**V PLANNING AND SHAPING**

- a. Cutting Key Ways
- b. Dove tail machining.

**Total Hours: 45**



## **U13GHP 401 HUMAN EXCELLENCES - PROFESSIONAL VALUES**

**L T P C**  
**0 0 2 1**

**(Common to all branches of Engineering and Technology)**

### **Course Objectives**

- To know the 5 Cs (Clarity, courage, confidence, commitment, compassion)
- To Know the 5 Es (Energy, Enthusiasm, Efficiency, Enterprise, Excellence)
- To Practice the IQ Questions and given to the result
- To Learn about Professional Ethics
- To know the examples for Self Control

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Acquire knowledge on the Clarity, courage, confidence, commitment, compassion for a good Professionalize
- Demonstrate Skills of IQ test
- Contribute to the better Management of Time
- Behave a good Professionalism from Quality Enhancement.

### **Course Content**

#### **PERSONALITY CONCEPTS - 5C'S & 5E'S**

**5 Hours**

Personality-concepts, definition, -types of personality-personality development activities- how to develop a good personality factors affecting personality development tools of improve personality-steps to a dynamic personality-5 C's and 5 E's

#### **TIME MANAGEMENT**

**5Hours**

Self-development – importance of self development – how to develop oneself – continuous learning – laser focus +persistence – working a plan – sound mind follows sound body –complete responsibility – practice – those who make it, made it – never give-up – meditation – ten commandments of self development – self control technique for teenagers.

#### **LEADERSHIP TRAITS**

**5Hours**

Leadership traits – style – factors of leadership – principles of leadership - time management – importance of time management – benefits – top five time sucks of the average Human –time management for college students. Passion for excellence – what is passion? – Why passion? – Value of life – index of life – fuel for fulfillment – secret of physical & spiritual fitness – improves learning ability.

#### **EMPOWERMENT OF MIND**

**5Hours**

IQ, - Factors affecting the intelligence quotient – IQ and the brain – sex – race – age – relationship between IQ & intelligence – how to develop good intelligence quotient power – exercise can improve IQ – food plan to increase IQ – meditation – reading – playing – try right with opposite hands – learn new things - the IQ tests. EQ – emotional Intelligence – list positive & negative emotions. SQ – spiritual quotients – definition – basic science of spiritual quotient – how to build SQ? – Relationship between IQ, EQ, SQ.





**MEDITATION****3 Hours**

Panchendhriya meditation – Introduction – practice – benefits.

**SIMPLIFIED PHYSICAL EXERCISE& YOGASANAS****7 Hours**

Asanas – revision of previous asanas–standing asanas: natarasana –virabhadrasana – pathangusthasana– ardhachandrasana–utthithatrikonasana–parsvakonasana.

**Total Hours: 30****REFERENCES:**

1. ICFAI University, “Personality & Self Development”
2. Dr.A Chandra Mohan, “Leadership”.
3. Swami Vivekananda, “Intelligence”.
4. Robert W. Bly , “Ways to make every second valuable”.
5. Vethathiri Maharishi, “Manavalkkalai Part-II”.
6. D.R Kiran&S.Bhaskar, “Professional Ethics& Human Values”.
7. Keith Ward& Cliff Bowman , “Extraordinary performance from ordinary people”.
8. Vethathiri Maharishi , ”Mind”.
9. Vethathiri Maharishi, “Manavalkkalai Part-I”.
10. Russell Kelfer , “Self Cotrol”.



# SEMESTER V

24 May

**U13ECT512          DIGITAL SIGNAL PROCESSING**  
**(Common to EEE / CSE / IT / EIE / MCE)**

**L T P C**  
**3 1 0 4**

**Course Objectives**

- Understand and analyze the characteristics of discrete signals and systems
- Apply mathematical tools for signal / system analysis
- Design digital filters.
- Learn the architecture and features of P-DSPs

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Understand the characteristics of discrete-time signals and discrete systems
- Analyze signal / system properties using mathematical tools
- Apply and develop algorithms for digital systems
- Illustrate efficient computation of DFT
- Discuss advanced features and architecture of generic P-DSP

**Course Content**

**DISCRETE TIME SIGNALS AND SYSTEMS**

**12 Hours**

Representation of a CT signal by samples – Sampling theorem – Reconstruction of a signal from its samples – Aliasing – DT Signals – Impulse, Step, Pulse, Sine, Exponential – Properties of DT signals - Transformation of independent variable – Shifting, scaling, folding - Discrete Time LTI systems – Properties – Impulse response – Convolution sum – Properties of Convolution

**Z-TRANSFORM AND SYSTEM ANALYSIS**

**12 Hours**

DTFT – Properties - Z transform – Forward Transform - Inverse Transform using Partial Fractions - Properties – Pole-Zero plot– Difference Equations - Transfer function - Analysis of Discrete Time systems using DTFT and Z Transform.

**DISCRETE FOURIER TRANSFORM**

**12 Hours**

Introduction to DFT – Properties of DFT – Efficient computation of DFT – FFT algorithms – Introduction to Radix-n algorithms – Radix – 2FFT – Decimation-in-Time and Decimation-in-Frequency algorithms – Butterfly diagram.

**DESIGN OF DIGITAL FILTERS**

**12 Hours**

FIR filter design: Linear phase characteristics - Windowing Technique – Rectangular, Hamming, Hanning, Blackmann windows – IIR filter design: Analog filter design - Butterworth and Chebyshev approximations – Impulse invariance and Bilinear transformations - FIR and IIR filter structures – Direct form I and II - cascade and parallel forms – Finite Precision effects.



## ADVANCED TOPICS AND PROGRAMMABLE DSP CHIPS

12 Hours

Concepts of multi-rate signal processing – Decimation and interpolation by integer factor – Sampling rate conversion – Introduction to DSP architecture - Von Neumann, Harvard, Modified Harvard architectures - MACunit–MultipleALUsModified Bus structures and memory access schemes in P-DSP – Multiple access memory – Multi-ported memory – VLIW architecture – Pipelining – Special addressing modes

**Theory:45Hr**

**Tutorial :15HrTotal Hours: 60**

### REFERENCES

1. Mrinal Mandel and Amir Asif, “Continuous and Discrete Time Signals and Systems”, Cambridge International Student Edition, Cambridge University Press, 2007.
2. JohnG.ProakisandDimitrisG.Manolakis, “DigitalSignalProcessing,Principles, AlgorithmsandApplications”,PHI, 3<sup>rd</sup> Edition.2000.
3. B. Venkataramani, M. Bhaskar, “Digital Signal Processors, Architecture, Programming and Applications”, Tata McGraw Hill, New Delhi, 2003. (Unit V)
4. JohnnyR.Johnson,“IntroductiontoDigitalSignalProcessing”,PHI, 2009.
5. Won Y. Yang et. Al., “Signals and Systems with MATLAB”, Springer International Edition, 2009
6. Steven W. Smith, “The Scientists and Engineer’s Guide to Digital Signal Processing”, California Technical Publishing, 1997.
7. James H. McClellan, Ronald W. Schafer, Mark A. Yoder, “Signal Processing First”, 2<sup>nd</sup> Edition.



## **U13MCT501      MICROPROCESSOR AND MICROCONTROLLER**

**L T P C**  
**3 0 0 3**

### **Course Objectives:**

- To study about the 8085 Microprocessor
- To study about data transfer methods
- To study about the peripheral devices
- To emphasize the basics of 8086 Microprocessor.
- Explains about the application of 8051

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Describe and differentiate the architectures of Microprocessor and microcontroller.
- Write assembly language programs for 8085 microprocessor and 8051 microcontroller.
- Effectively use interrupts and data transfer schemes for application development.
- Design interface circuits to interact with memory devices, I/O devices and develop real time applications.

### **Course Content**

#### **8085 MICROPROCESSOR**

**9Hours**

Organization of Micro Computers – Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes - instruction and machine cycles with states and timing diagram - 8085 assembly language programming.

#### **INTERFACING AND I/O DEVICES**

**9Hours**

Need for Interfacing – Memory Interfacing: address space partitioning – address map – Address decoding – Designing decoder circuit for the given address map .I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts. DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices –serial data transfer.

#### **DESIGN USING PERIPHERAL DEVICES**

**9Hours**

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 using 8085 programs – Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

#### **8051 ARCHITECTURE**

**9 Hours**

Microcontroller Hardware – I/O Pins, Ports – External memory – Counters and Timers – Serial data I/O – Interrupts – 8051 Assembly Language Programming: Instruction set of 8051, Addressing modes, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, interrupts and returns interrupts and returns interrupt handling.



## **APPLICATIONS**

**9Hours**

Applications of 8051 Microcontroller: Interfacing of Keyboards – Interfacing of Display Devices– Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Multiple interrupts – Serial Data Communication – Network Configuration.

**CASE STUDIES: Interfacing of Display Devices.**

**Total Hours : 45**

## **REFERENCES:**

1. Ramesh Goankar, “Microprocessor Architecture. Programming and Applications with the 8085”, Printice hall India, - 2002.
2. Kennath J. Ayala, “The 8051 Microcontroller Architecture, Programming and Applications”, Penram International (India), Mumbai, 3<sup>rd</sup> edition 2004
3. Aditya P Mathur, “Introduction to Microprocessor”, Tata McGraw Hill, 3rd edition, New Delhi 2003
4. B.P. Singh, “Microprocessors and Microcontrollers”, 1st Edition, Galgotia, New Delhi, 1997.
5. Embedded Controller Hand book, Intel Corporation, USA.
6. Microcontroller Hand Book, INTEL, 1984.



**Course Objectives**

- To study the open loop and closed loop systems.
- To study time response of first and second order systems and basic state variable analysis and to do simple problems.
- To study the concept of stability and criteria for stability and to do simple problems.
- To study the frequency response through polar plots and Bode plots and Nyquist stability criteria and to do simple problems.
- To study the compensation technique that can be used to stabilize control systems.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Define the open loop and closed loop systems.
- Design time response of first and second order systems and basic state variable analysis.
- Sketch the Frequency response of second order system using polar plots ,Bode plots and Nyquist stability criteria and to do simple problems.
- Design a compensator to make a unstable system an stable system.

**Course Content****INTRODUCTION****9+3Hours**

Open loop and closed loop systems - Examples - Elements of closed loop systems - Transfer function of elements - Modeling of physical systems - Mechanical systems - Translational and Rotational systems - Electrical networks - Block diagram – Signal flow graph - Mason's gain formula. Transfer function - Transfer function of DC servomotor, AC servomotor - Transfer function of potentiometer, Synchro. STEPPER MOTOR

**TIME DOMAIN ANALYSIS****9+3Hours**

Standard Test signals – Time response of second order system - Time domain response Performance criteria - Types of systems - Steady state error constants - Generalised error series - P , PI, PID controllers And different types of tuning methods.

**FREQUENCY RESPONSE OF SYSTEMS****9+3Hours**

Frequency domain specifications - correlation between time and frequency response for second order systems-Bode plots- Assessment of stability - Gain Margin and phase Margin Assessment – Lead, lag and Lead lag compensation using Bode Plot - Polar plots

Use MATLAB for bode plot and Compensation design.

**STABILITY OF CONTROL SYSTEMS****9+3Hours**

Characteristic equation - Routh Hurwitz criterion of stability - Nyquist stability - Nyquist stability criterion - Assessment of relative stability – Gain and Phase Margin. Root Locus concept - Root Locus procedure - Root Locus construction - Root contours. Use MATLAB for stability analysis of higher order systems.



## STATE SPACE ANALYSIS

**9+3 Hours**

Introduction to state space analysis - Phase variable and canonical forms - State transition matrix - Solutions to state space equation - Discretisation of state space equation - Controllability and Observability of systems.

**CASE STUDIES: Temperature control system**

**Theory:45Hr**

**Tutorial:15Hr**

**Total Hours: 60**

## REFERENCES

1. Nagrath I J, and Gopal, M, 'Control Systems Engineering" Prentice Hall of India, New Delhi, 5<sup>th</sup> edition, 2009.
2. Katsuhiko Ogata, "Modern Control Engineering", Pearson Education, 4<sup>th</sup> Edition, 2002
3. Chesmond C.J. "Basic Control System Technology", Viva Low Priced Student Edition, 1998.
4. Datton K., Banaclough W. and Thompson S., "The Art of Control Engineering", Addison Wesley, 2000.
5. Dorf R.C. and Bishop R.H., "Modern Control systems", Addison – Wesley, 1995
6. Leonard N.E. and William Levine, "Using MATLAB to Analyze and Design Control Systems", Addison Wesley, 1995.
7. Ogata K, "Modern Control Engineering", Pearson Education, New Delhi, 4<sup>th</sup> Edition 2006.
8. Kuo B C, "Automatic Control Systems", Prentice-Hall Of India Pvt. Ltd, New Delhi, 8<sup>th</sup> edition, 2004.
9. Norman C. Nise S, "Control system Engineering", John Wiley & Sons, Singapore 4<sup>th</sup> Edition





**Course Objectives**

- CNC machining is one of the widely accepted machining methods in industries
- To study the fundamentals of CNC machines
- To study the features of CNC Machines and Retrofitting
- To study about types of measuring systems in CNC machines
- To study about the maintenance features of CNC Machines

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Explain the fundamentals of CNC machines , differentiate the advantages and disadvantages of different types of CNC machines
- Describe the constructional features of CNC machines
- Develop a CNC Part programming for the basic milling and turning operations
- Summarise various maintenance procedures practiced in industry for CNC Machines

**Course Content****FUNDAMENTALS OF CNC MACHINES****9 Hours**

Introduction to Computer Numerical Control: CNC Systems – An Overview of Fundamental aspects of machine control, Different types of CNC machines – Advantages and disadvantages of CNC machines- DNC and Adaptive control

**CONSTRUCTIONAL FEATURES OF CNC MACHINES AND RETROFITTING****9Hours**

Features of CNC Machines: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Spindle bearing – Arrangement and installation. Slide ways. Recirculating ball screws – Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors. Retrofitting of Conventional Machine Tools.

**CONTROL SYSTEMS, FEED BACK DEVICES AND TOOLING****9Hours**

Description of a simple CNC control system. Interpolation systems. Features available in a CNC system – introduction to some widely used CNC control systems. Types of measuring systems in CNC machines – Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation. Qualified and pre-set tooling – Principles of location – Principles of clamping – Work holding devices.

**CNC PART PROGRAMMING****9Hours**

Part Program Terminology- G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming: Fixed cycle, canned cycle – Computer Assisted part programming – APT language – CNC part programming using CAD/CAM- Introduction to Computer Automated Part Programming.



## **ECONOMICS AND MAINTENANCE**

**9Hours**

Factors influencing selection of CNC Machines – Cost of operation of CNC Machines  
– Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines

**CASE STUDIES: Case study on Preventive Maintenance, Intelligent systems such as automated handling and CMMs**

**Total Hours: 45**

### **REFERENCES:**

1. Radhakrishnan P., Computer Numerical Control Machines, New Central Book Agency, 2011.
2. Groover, M.P., Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall, 2007.
3. Yoram Koren, "Computer Control of Manufacturing Systems", Pitman, London, 1987.
4. Berry Leatham – Jones, "Computer Numerical Control", Pitman, London, 1987.
5. Steave Krar and Arthur Gill, "CNC Technology and Programming", McGraw Hill, 1990.
6. Hans B. Kief and T. Fredrick Waters, "Computer Numerical Control", Macmillan/McGraw-Hill, 2000.
7. Thyer, G.E., "Computer Numerical Control of Machine Tools", 2<sup>nd</sup> edition, B/H NEWNES, 1993.
8. Mike Mattson, "CNC Programming", Thomson Learning, 2003.



**U13MCT504      PROCESS CONTROL AND  
INSTRUMENTATION**

**L T P C  
3 0 0 3**

**Course Objectives**

- To study the basic characteristics of first order and higher order processes.
- To study about temperature, displacement, force and torque measurement.
- To study pressure, flow and level measurements.
- To get adequate knowledge about the characteristics of various controller modes and methods of tuning of controller.
- To study about the construction, characteristics and application of control valves.

**Course Outcomes:.**

**After successful completion of this course, the students should be able to**

- Classify and test for various characteristics, orders of measurement, calibrations, standards and errors in measurement.
- Setup, calibrate and configure control loops of different process stations.
- Develop a suitable algorithm using different controller method.
- Use various tuning methods related to control system

**Course content**

**GENERAL CONCEPTS OF MEASUREMENT**

**9 Hours**

Generalized Measurement System – Performance Characteristics – Static and Dynamic Characteristics – Errors in Measurements – Calibration and Standards – Generalized Performance of Zero Order, First Order and Second Order Systems – Classifications of Transducers.

**TEMPERATURE, DISPLACEMENT, FORCE, TORQUE MEASUREMENT**

**9 Hours**

Filled Thermometers – RTD – Thermistor, Thermocouple, Non Contact Total Radiation Pyrometer – Optical Pyrometer. Load Cells – Different Types -Strain Gauges Resistive and Semiconductor – Different Forms – Measurement Circuit- LVDT Characteristics- Piezo Electric Transducer – Different Types – Characteristics.

**PRESSURE, FLOW AND LEVEL MEASUREMENTS**

**9 Hours**

Pressure Measurement: Manometers – Elastic Transducers – Bourdon Gauge – bellows – diaphragm – Calibration of Pressure Gauge using Dead Weight Testers. Vacuum Measurement: McLeod Gauge, Thermal Conductivity Gauge – Ionization Gauge. Flow Measurement: Orifice, Venturimeter, Turbine Flow meter, Hot wire Anemometer. Level Measurement: Float Level, surge type, Differential Pressure Type, Electrical Type- Resistance and Capacitance.



## **PROCESS CONTROL**

**9 Hours**

Need for process control-process variables-dynamics of simple pressure, flow, level & temperature processes - basic control actions - characteristics of on off , proportional, integral and derivative control modes - PI, PD and PID control modes - feed forward control - ratio control - cascade control - inferential control - selective control - split range control - adaptive control - Process control instrumentation symbols and diagrams.

## **CONTROLLERS AND TUNING**

**9 Hours**

Pneumatic and Electronic PID Controllers – Reaction curve tuning (Zeigler- Nichols)- Zeigler-Nichols Open Loop method- Loop time Constant method- Continuous Cycling method (Ziegler-Nichols)- Damped cycle tuning method

**CASE STUDY:** Measurement Application – Control Application in Industries, Design of Fuzzy-Logic based controller, Design of Neural Network based controller.

**Total Hours: 45**

## **REFERENCES:**

1. Ernest O. Doebelin, “Measurement Systems Application and Design”, McGraw-Hill, 5<sup>th</sup> Edition, 2004.
2. Beckwith, T.G. and Buck, N.L. “Mechanical Measurements” Addison Wesley Publishing Company Limited, 1995.
3. Sawney, A.K. and Puneet Sawney, “A course in Mechanical Measurements and Instrumentation and Control,” Dhanpat Rai & Co, New Delhi, 12<sup>th</sup> edition , 2001.
4. Wolfgang Altmann, “Practical Process Control for Engineers and Technicians”, Newnes, An Imprint of Elsevier, 2005.
5. Jain R.K. “Mechanical and Industrial Measurements” Khanna, Delhi, 1984.
6. Liptak .B.G, „Process control instrument engineers” Handbook, , Butterworth and Heinemann, 3<sup>rd</sup> edition 1995.
7. DVS Murthy “Transducers and Instrumentation Printing Hall of India”, New Delhi, 2003
8. Stephanopoulos.G, “Chemical process control”, Prentice Hall of India, New Delhi, 8<sup>th</sup> Edition 2009.



## U13 MCT 505 DESIGN OF MACHINE ELEMENTS

L T P C  
3 1 0 4

(Use of approved design data book is permitted)

### Course Objectives

- To understand the different design concepts.
- To enable the students to understand the considerations in design such that the functional and strength requirements are satisfied.
- To learn the evaluation and design of Simple Machine Components.
- To understand different types of welded joints.
- To understand the concept of friction, contact types in designing bearing

### Course Outcomes

After successful completion of this course, the students should be able to

- Demonstrate various basic machine elements used in machine design.
- Analyze the stress on machine members and identify failure modes of mechanical parts.
- Develop and analyze bolted joints, shafts, couplings and welded joints.
- Solve problems related to springs, levers, bearings and flywheels.

### Course content

#### STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

11+3 Hours

Introduction - factor influencing machine design, selection of materials based on mechanical properties - Direct, Bending and torsional stress equations - Impact and shock loading - calculation of principal stresses for various load combinations, eccentric loading - Design of curved beams - crane hook and "C" frame - Factor of safety - theories of failure - stress concentration - design for variable loading - Soderberg, Goodman and Gerber relations.

#### SHAFTS AND COUPLINGS

7+3 Hours

Design of solid and hollow shafts based on strength, rigidity - critical speed - keys and keyways - design of muffler and knuckle joints - Design of rigid and flexible couplings - shock absorbing couplings

#### FASTENERS AND WELDED JOINTS

9+3 Hours

Threaded fasteners - Design of bolted joints including eccentric loading - Design of welded joints for pressure vessels and structures - theory of bonded joints.

#### SPRINGS AND LEVERS

9+3 Hours

Design of helical, leaf, disc and torsional springs under constant loads and varying loads - Concentric torsion springs - Belleville springs - Design of Levers.

#### BEARINGS AND FLYWHEELS

9+3 Hours

Selection of bearings and - sliding contact and rolling contact - types - Cubic mean load - Design of journal bearings - McKee equation - Lubrication in journal bearings - calculation of bearing dimensions - Design of flywheels involving stresses in rim and arm.



**CASE STUDIES: Case study on wear of gear trains- Case study on Deep Groove ball bearing test rig.**

**Thory:45HrTutorial:15Hr**

**Total Hours: 60**

Note:(Use of PSG Design Data Book is permitted in the University examination)

**REFERENCES:**

1. Joseph Edward Shigley and Charles R. Mischke, "Mechanical Engineering Design", McGraw-Hill International, 7th Edition, 2003.
2. Sundarajamoorthy.T.V, Shanmugam.N, "Machine Design", Khanna Publishers 7th Edition 2004.
3. Prabhu.T.J, "Fundamentals of Machine Design" Bharat Institute of Science and Technology.
4. Juvinall, R.C. and Marshek, K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, 3rd edition,
5. Bhandari, V.B, "Design of Machine Elements", Tata McGraw-Hill
6. Norton, R.L, "Design of Machinery", Tata McGraw-Hill
7. Orthwein, W., "Machine Component Design", Jaico
8. Ugural, A.C., "Mechanical Design – An Integral Approach", McGraw-Hill
9. Patil, R.B, "Design of Machine Elements", Tech-Max



24 May

### **Course Objectives**

- To correlate the concepts studied in the instrumentation and control subject for the real world applications.
- To understand the concept of controlling the parameters based on measurement.

### **Course Outcomes.**

**After successful completion of this course, the students should be able to**

- Measure and log various physical quantities.
- Perform calibration of measuring instruments.
- Analyze and present the findings of experimental observations in both written and oral format.

### **LIST OF EXPERIMENTS**

1. Calibration of pressure gauge using dead weight pressure gauge tester
2. Calibration of vacuum sensor using vacuum measurement set-up
3. Measurement of temperature using thermocouple, RTD and thermistor
4. Speed Measurement using Stroboscope and tachometer
5. Force measurement using proving ring and load cell
6. Torque measurement using strain gauge
7. Power measurement using Prony-brake dynamometer
8. Strain measurement using strain gauge
9. Displacement measurement using LVDT
10. Speed measurement and control of DC servo motor using PI controller
11. Noise measurement using sound-level meter

### **LIST OF EQUIPMENTS**

1. Vacuum measurement set-up
2. Prony-brake dynamometer with motor and accessories
3. Temperature measuring devices – thermocouple, RTD and thermistor.
4. Speed measurement system with accessories
5. DC-servo motor with PI controller interface
6. Digital sound-level meter
7. Dead weight pressure gauge tester
8. Displacement measurement set-up – LVDT
9. Strain measurement set-up
10. Torque measurement set-up
11. Force measurement set-up with load cell and proving ring

**Total Hours: 45**





## **U13 MCP502 CAD/CAM LABORATORY**

**L T P C**  
**0 0 3 1**

### **Objectives**

- To study the various commands used in PRO E software.
- To study drafting and assembly through PRO E software for various machine components

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Model and assemble a given three dimensional engineering components.
- Perform various analyses on simple structures for the application of different loads.
- Generate CNC programs for a given components to work with CNC machines (Turning and Milling).
- Analyze and present the findings of experimental observations in both written and oral format.

## **COMPUTER AIDED DESIGN AND ANALYSIS LAB**

### **LIST OF EXPERIMENTS**

1. Solid modeling using SOLIDWORKS / ProE / CATIA / IDEAS software of given components / product assemblies (at least 2 components/product assemblies)
2. Analysis of engineering problems using FEA package (any 2 components)

### **LIST OF EQUIPMENTS**

1. Any CAD software
2. Any FEA software

## **COMPUTER AIDED MANUFACTURING LAB**

### **LIST OF EXPERIMENTS**

1. Manual part programming using G and M codes for turning, step turning, taper turning and thread cutting and radius turning on cylindrical components.
2. Given a component drawing to write the manual part programming and execute on CNC Milling Machine.
3. Generation of NC codes and simulation of tool path using Master CAM software.
4. Post processing of NC code file for various controllers(FANUC, SINUMERIC)

### **LIST OF EQUIPMENTS**

1. CNC Lathe
2. CNC Milling Machine
3. Master CAM software EDGE CAM software
4. Computer nodes

**Total Hours: 45**



**U13MCP503      MICROPROCESSOR AND  
MICROCONTROLLER LABORATORY**

**L   T   P   C  
0   0   3   1**

**Course Objectives**

- To experimentally understand the operation of Intel 8085 microprocessor and 8051 microcontroller.
- To realize the interfacing concepts with 8255, 8279.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Develop assembly language programs to solve simple mathematical and logical problems.
- Debug and test the I/O interfacing circuits and programmes.
- Integrate real time systems with microcontroller.
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

**I. PROGRAMMING**

**30 Hours**

1. Addition and subtraction of two 8-bit numbers in 8085 & 8051.
2. Addition of 16 bits numbers in 8085 & 8051.
3. To arrange a series of numbers in Ascending order and Descending order in 8085.
4. 8-bit Multiplication in 8085 & 8051.
5. 8-bit Division in 8085 & 8051.
6. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion in 8085.

**II. INTERFACING**

**15 Hours**

1. Analog to digital conversion in 8085.
2. Digital to analog conversion in 8085.
3. Stepper motor controller in 8051.
4. DC motor controller interface using 8051.

**Total Hours: 45**



## **U13GHP501 HUMAN EXCELLENCE SOCIAL VALUES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>

(Common to all branches of Engineering and Technology)

### **Course Objectives**

- To produce responsible citizens to family and society
- To uplift society by pure politics and need education
- To realize the value of unity, service
- To immunize the body
- To get Divine peace through inward travel

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Understand the Duties and responsibilities of a human being.
- Demonstrate skills required for the Disparity among human being.
- Behave as a responsible citizen
- Analyze Impact of Science in Society.

### **Course Content**

#### **RESPONSIBLE CITIZENS TO FAMILY AND SOCIETY                      5 Hours**

Evolution of man - evolution of universe – creating theory – evolution theory – theory permanence theory – mithya – maya or illusion – evolution of living being –

#### **POLITICS AND NEED EDUCATION    5 Hours**

Human being & group – unity of man in society – relationship between individual – society.

#### **DEVELOPMENT OF SCIENCE, EDUCATION & ECONOMICS 5 Hours**

Duties and Responsibilities- Duty to self, family, society and world – politics & society – education & society – case study and live example – impact of science, economic & society.

#### **DISPARITY AMONG HUMAN BEINGS    5 Hours**

Disparity among human beings – seven values – bodily structure – character of personality – advancement of knowledge or intellectual clarity – fame of service – physical strength – health – financial status. sixteen factors heredity – food – historical age – place of living – education – work – government – art – effort – physical age – friendship – opportunity – research – practice – accepted sentiments of society – morality.

#### **SERVICE AND SACRIFICE    3Hours**

Social welfare – need – pure & pure society.



## YOGASANAS & MEDITATION

7Hours

Pancha bhootha navagraha meditation – Introduction – practice – benefits.

Sitting asanas: mahamudhra – ustrasana– gomukhasana– matsyasana –  
ArdhaMatsyendrasana.Upward lying asanas: setubhandasana–viparitakaranai –  
sarvangasana – halasana. Downward lying asanas: arthasarvangasana –  
adhomukhasvanasana–padmamayura

**TotalHours :30**

### REFERENCES:

1. World peace plane-----Vethathiri Maharishi
2. Prosperous India----- Swami Vivekananda
3. SamudhayachikkalukkananalaAaivugal ----- Vethathiri Maharishi
4. World Community Life ----- Vethathiriyam



# SEMESTER VI

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**Course Objectives**

- To study about Mechatronics Design process.
- To study the data acquisition and control case studies
- To study about the application of Mechatronics system

**Course Outcomes:.**

**After successful completion of this course, the students should be able to**

- Differentiate mechatronic design process from conventional design.
- Select appropriate communication module for system design.
- Apply Mechatronics design process for new product development.
- Summarize working of advanced controllers and Microsystems

**Course Content****MECHATRONICS SYSTEM DESIGN****9Hours**

Mechatronics Design process – Types of Design – Traditional and Mechatronics designs, Advanced approaches in Mechatronics - industrial design and ergonomics, safety.

**SYSTEM INTERFACING****9Hours**

Introduction-selection of interface cards-DAQ card-single channel-multichannel-RS232/422/485 communication- IEEE 488 standard interface-GUI card-GPIB-Ethernet switch - Man machine interface.

**DATA ACQUISITION SYSTEM****9 Hours**

Introduction – Cantilever Beam Force Measurement system–Testing of Transportation bridge surface materials – Transducer calibration system for Automotive applications – Strain gauge weighing system – Solenoid Force-Displacement calibration system – Rotary optical encoder

**DATA ACQUISITION AND CONTROL SYSTEM****9Hours**

Introduction – Thermal cycle fatigue of a ceramic plate – pH control system – De-Icing Temperature Control system – Controlling temperature of a hot/cold reservoir – Skip control of a CD player– Autofocus Camera, exposure control – Pick and place robot.

**ADVANCED APPLICATIONS IN MECHATRONICS****9 Hours**

Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence, Fuzzy Logic Applications, Micro actuation – Micro robot – Micro pump – Applications of micro Mechatronics components.

**Total Hours: 45**

## REFERENCES:

1. Devdas Shetty and Richard A. Kolk, "Mechatronics System Design", Thomson Asia Pte. Ltd., Singapore, 2<sup>nd</sup> edition 2010.
2. W.Bolton, "Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering", 5<sup>rd</sup> Edition, Pearson Education Ltd., 5<sup>th</sup> Edition 2013.
3. Brian Morriss, "Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics", McGraw Hill International, 1995.
4. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", Chapman and Hall, London, 1993.
5. Georg pelz, Mechatronic Systems: Modeling and simulation with HDL's, John wiley and sons Ltd, 2003
6. HMT "Mechatronics", Tata McGraw Hill, 1998.



**Course Objectives**

- This course aims to provide basic concepts and various components in fluid power systems.
- It deals about the application and low cost automation in industries.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Describe the concept of fluid power and use symbols of various components used in fluid power.
- Design fluid power circuits by selecting appropriate control valves and actuators.
- Summarize the common faults and troubleshooting methods for fluid power circuits.

**Course Content****FLUID POWER SYSTEMS AND FUNDAMENTALS****6Hours**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids. Fluid power symbols.

**HYDRAULIC SYSTEM AND COMPONENTS (PUMPS AND ACTUATORS)****9 Hours**

Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps.

Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic - Construction and application. Cushioning mechanism, Rotary actuators - Gear, Vane and Piston motors.

**HYDRAULIC VALVES, ACCUMULATORS AND CIRCUITS 10 Hours**

Directional control valve – 3/2 way valve – 4/2, 4/3 way valve – Shuttle valve – check valve. Pressure control valves, Flow control valve – Fixed and adjustable, electrical control solenoid valves.

Types of accumulators, Accumulators circuits, Intensifier – Circuit and Application, Speed control circuits, synchronizing circuit and industrial application circuits – copying circuit and press circuit.

**PNEUMATIC SYSTEMS, COMPONENTS AND CIRCUITS 10Hours**

Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves and pneumatic actuators. Pneumo-hydraulic circuit, Sequential circuit design for simple applications using cascade and step counter method.

**FLUID LOGIC CONTROL SYSTEMS AND MAINTENANCE 10 Hours**

Hydro Mechanical servo systems, Electro-hydraulic and Electro-pneumatic systems and proportional valves. Logic and switching controls - PLC applications in fluid power control, Maintenance - Failure and trouble shooting in fluid power systems.





## **CASE STUDIES**

**Designing of Hydraulic and Pneumatic circuits for applications like Rough terrain forklift, Plastic Injection molding, Paint Spray system, Clamping, Loading and Assembly lines.**

**Total Hours :45**

## **REFERENCES:**

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education Inc., 7<sup>th</sup> Edition 2009.
2. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw-Hill, 2009.
3. Michael J. Pinches and John G. Ashby, "Power Hydraulics", Prentice-Hall, 1989.
4. Andrew Parr, "Hydraulics and Pneumatics (HB)", Jaico Publishing House, 2005.
5. James A. Sullivan, "Fluid Power: Theory and Applications", C.H.I.P.S., 4<sup>th</sup> edition, 2007.



**Course Objectives**

- To explain the operation of relays, pushbuttons, limit switches, and other basic control devices.
- Using ladder diagrams, design basic motor control circuits.
- Describe the hardware of a PLC, identifying the functions of the main components.
- To explain the PLC programs to perform specified discrete sequential control operations.
- Configure a PLC, including choosing appropriate addressing for I/O for a specified application.

**Course Outcomes****After successful completion of this course, the students should be able to**

- Explain and use relays, pushbuttons, limit switches, and other basic control devices for automation.
- Describe the hardware and architecture of PLCs and also identify the analogy of relay logic components.
- Write PLC programmes using ladder diagrams for complex applications.
- Summarise various maintenance procedures practiced in industry for PLC based control systems.

**Course Content****INTRODUCTION****9 Hours**

Programmable controller – need for PLC – modular PLC and fixed PLC – block diagram of PLC – input and output modules – power supply – types of PLC system.

**HARDWARE MODULES****9 Hours**

CPU – processor's function – processor's operating system – processor ports – interfacing PC to PLC – processor operating modes – PLC system memory and application memory – input modules – output modules – module selection – PLC internal operation and signal processing – input and output processing – timing consideration.

**PROGRAMMING OF PLC SYSTEM****9 Hours**

Introduction to IEC 61131 - System functions – sequence control – ladder logic – programming sequences – limitation of ladder programming – logic instruction sets – standard PLC functions – special function relays – data handling instructions – arithmetic instructions – data manipulation – program subroutines – programming examples.

**PLC COMMUNICATION AND DCS****9 Hours**

PLC communication ports – serial communications – RS232 – standard requirements – communication between several PLCs – PLC field bus - Manufacturing



Automation Protocol (MAP) – Technical Office Protocol (TOP) - Distributed control system (DCS) – building blocks – descriptions and functions of field controlled units – operator stations – data highways – redundancy concepts – DCS system integration with PLC and computers – communication in DCS.

## **PLC MAINTENANCE AND CASE STUDIES**

**9 Hours**

PLC maintenance – internal PLC faults – faults external to PLC – programmed error – watch dogs – safety – hardware safety circuits – troubleshooting.

**Case Studies:** PLC as robot controller and FMS – PLC to factory automation – PLC in process control

**Total Hours: 45**

## **REFERENCES:**

1. Frank D. Petruzella, “Programmable Logic Controllers”, McGraw-Hill Companies, 3<sup>rd</sup> Edition, March 2013.
2. Lukcas M.P., “Distributed Control Systems”, Van Nostrand Reinhold Co., New York, 1986.
3. Ian G. Warnock, “Programmable Controllers Operation and Application”, Prentice Hall International, UK, 1992.
4. John W. Webb and Ronald A. Reis, “Programmable Logic Controllers – Principles and Applications”, Prentice Hall Inc., New Jersey, 3<sup>rd</sup> Edition, 1995.
5. Krishnakant, “Computer Based Industrial Control”, Prentice Hall of India, 1997.



Use of approved steam tables and charts are permitted.

Use of approved heat and mass transfer data book is permitted

**Course Objectives**

- Will be introduced to the laws of thermodynamics with their applications related to I.C engines, heat and mass transfer.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Define the laws of thermodynamics and describe the properties of the system
- Explain the various air standard cycles and describe the working of I.C engines
- Distinguish various modes of heat transfer and calculate the rate of heat transfer for various applications
- Discuss the concepts of mass transfer and derive their correlations.

**Course Content****LAWS OF THERMODYNAMICS****9+3 Hours**

Systems-closed and open systems –properties, processes and cycles- equilibrium-work and heat transfers-first law for a closed system and flow processes - enthalpy - second law –entropy- entropy change- reversibility.

**AIR-STANDARD CYCLES****9+3 Hours**

Air standard cycles: Carnot cycle - Otto cycle - Diesel cycle - Brayton cycle - cycle efficiency - two stroke and four stroke engines- SI, and CI engines. **Case Studies** – Application of standard air cycles in Engines.

**HEAT TRANSFER : CONDUCTION****9+3 Hours**

Basic Concepts- Mechanism of Heat Transfer - Conduction, Convection and Radiation - Fourier Law of Conduction - General Differential equation of Heat Conduction -Cartesian and Cylindrical Coordinates - One Dimensional Steady State Heat Conduction - Conduction through Plane Wall, Cylinders and Spherical systems.

**CONVECTION AND RADIATION****9+3 Hours**

Convection: Basic Concepts –Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – External Flow and Internal Flow – Flow over Plates and Cylinders

Radiation: Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchhoffs Law – Black Body Radiation –Grey body radiation -Shape Factor Algebra – Electrical Analogy

**MASS TRANSFER****9+3 Hours**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations

**Theory:45Hr Tutorial:15Hr****Total Hours: 60**

## REFERENCES

1. Yunus A. Cengel and Michael A Boles, “Thermodynamics – An Engineering Approach, in SI Units”, , Tata McGraw Hill, 5th edition New Delhi, 2006.
2. CP.Kothandaraman, S.Subramanya, “ Fundamentals of Heat and Mass Transfer” New Age International Publishers, New Delhi, 3rd edition, 2008.
3. Nag P. K, „Engineering Thermodynamics" Tata McGraw-Hill, 4th edition 2008.
4. Eastop T.D. and McConkey, “Applied Thermodynamics for Engineering Technologists”, Pearson, New Delhi, 5th Edition, 2004.
5. C. P. Kothandaraman, S. Domkundwar and A.V.Domkundwar, “A course in Thermal Engineering” Dhanpatrai & Co, 5th edition, 2000.
6. Frank P. Incropera and David P. DeWitt, “Fundamentals of Heat and Mass Transfer” John Wiley, Singapore, 5th edition, 2006.



## **U13MCT 604      EMBEDDED SYSTEM DESIGN**

**L T P C**  
**3 0 0 3**

### **Course Objectives**

- Introduce to features that build an embedded system.
- To study the Embedded Software Architecture.
- To study Techniques of inter facing between processors & peripheral device related to embedded processing.
- To explain real time operating systems, inter-task communication.
- To present in lucid manner the basic concepts of systems programming like operating system, assembler compilers etc and to understand the management task needed for developing embedded system.

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Summarize the embedded system design process and their challenges.
- Describe and analyze various Embedded Software Architectures.
- Design an embedded system using real time operating system and distinguish various debugging techniques.
- Explain about embedding the software into the target system.

### **Course Content**

#### **INTRODUCTION TO EMBEDDED SYSTEMS**

**9 Hours**

Overview of embedded systems, embedded system design process, challenges—common design metrics and optimizing them. Shared data problem, Interrupt Latency.

#### **PIC MICROCONTROLLER**

**9 Hours**

Introduction – CPU architecture – Instruction set – Addressing modes – Loop timing – Timers – Interrupt logic – I/O expansion – IIC bus operation– A/D converter.

#### **EMBEDDED SOFTWARE ARCHITECTURE**

**9 Hours**

Round robin - Round robin with interrupts - Function Queue scheduling Architecture - Real time operating systems Architecture - Selecting architecture.

#### **REAL TIME OPERATING SYSTEM**

**9 Hours**

Tasks and Task states - Tasks and Data - Semaphore and shared data -Message queues, mail boxes and pipes - Encapsulating semaphores and queues - Timer functions - Events - Memory management - Interrupt routines in an RTOS Environment - **Case study: Design of an embedded system (Underground tank monitoring System).**

#### **EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND DEBUGGING**

**9 Hours**

Linker/Locators for embedded software - embedded software in to the target system - Testing on host machine: Basic techniques - more Advanced techniques - Limitations and shortcomings - Instruction set simulators – The assert macro - Testing using laboratory tools.



**REFERENCES :**

1. David E. Simon, “An embedded software primer”, Addison – Wesley, Indian Edition Reprint (2009).
2. Vahid, Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction - Frank John Wiley & Sons, Inc. 2002
3. John B. Peatman, “Design with PIC Microcontrollers” Prentice Hall, 2003.
4. Steve Heath, „Embedded System Design“, II edition, Elsevier, 2003.
5. Rajkamal, „Embedded System – Architecture, Programming, Design“, Tata McGraw Hill, 2008
6. K.V.K.K.Prasad “Embedded /Real-Time Systems: Concepts, Design and Programming” Dream tech Press, reprint 2009



**U13MC P601    HYDRAULICS AND PNEUMATIC  
LABORATORY**

**L   T   P   C  
0   0   3   1**

**Course Objectives**

- Expose the students to technology of generation, control and transmission of power using pressurized fluids, with hands on training.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Select the actuators and valves for the design of fluid power circuits.
- Design and simulate the fluid power circuits using software tool.
- Test the simulated output by constructing the fluid power circuits using suitable actuators and valves.
- Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EXPERIMENTS**

1. Design and testing of the following hydraulic circuits:
  - i) Pressure control
  - ii) Flow control
  - iii) Sequential circuit using an Electro hydraulic Trainer kit.
2. Design and testing of the following pneumatic circuits:
  - i) Pressure control
  - ii) Flow control
  - iii) Circuits with logic controls
  - iv) Circuits for multiple cylinder sequencing in Pneumatic, Electro pneumatic Trainer kits.
3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation Studio software.

EQUIPMENTS	QUANTITY
<b><u>Hydraulic equipments</u></b>	
1    Pressure relief valve	2
2    Flow control valves	2
3    Limit switches	2
4    Linear actuator	4
5    Rotary actuator	2
6    Double solenoid actuated DCV	3
7    Single solenoid actuated DCV	2
8    Hydraulic power pack with pump and pressure relief valve	1
<b><u>Pneumatics equipments</u></b>	
1    Pneumatic trainer kit with FRL Unit, Single acting cylinder, push button actuated DCV and manually	1





	actuated DCV	1
2	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV	1
3	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV with sensors/ magnetic reed switches	1
4	Pneumatic trainer kit with FRL unit with PLC with Interface card	10 licenses
5	Automation studio software	

**Total Hours: 45**



**Course Objectives**

- To provide a clear understanding on the basic concepts of embedded system design
- To understand the basic scheme for interfacing IO devices

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Design and debug embedded system hardware.
- Experiment the basic schemes for interfacing IO devices.
- Design real time embedded system using RTOS

**LIST OF EXPERIMENTS****8051 MICRO CONTROLLER -IO PROGRAMMING**

1. Read data from port P2 and P3. Add data and display result on port P0. Glow LED connected at port pin P1.1 if carry flag set after addition.
2. Write program to read switch connected at port pin P1.0, toggle it and send to port pin P1.1
3. Write a program to generate square wave of 50% duty cycle having frequency 5 KHz at port pin P1.0 using timer 1 in mode 2. Modify program to generate pulse waveform of 70% duty cycle using timer on the same pin.

**INTERRUPTS AND TIMER APPLICATION**

4. Generate external interrupt INT0 and INT1 by connecting push button switch. Glow LEDs connected at port 1 one by one when interrupt INT0 occurs. LEDs should flash when interrupt INT1 occurs.

**INTERFACING EXPERIMENTS**

5. Interface LCD with the microcontroller. Display your name on the LCD.
6. Interface ADC0808 with 89C51 microcontroller. Write program to read analog voltage applied at the input of ADC. Display it on LCD.

**PIC MICRO CONTROLLER - IO PROGRAMMING**

7. Introduction to Software Tools MPLAB, PROTEUS.
8. Delay Loops Applications Flasher & Counter

**INTERRUPTS AND TIMER APPLICATION**

9. TMR0 Application Counter Using TMR0
10. Interrupt Application Controlling flashing speed of a flasher

**INTERFACING EXPERIMENTS**

11. Application for Keypad and LCD
12. Analog Digital Conversion



**(Common to all branches of Engineering and Technology)**

(Method of End Semester Evaluation : Practical : 60 marks, Online Exam : 40 marks)

**Course 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**

**After successful completion of this course, the students should be able to**

- Present the individual, academic curricular and career profiles.
- Speak to prove the industry-ready communication competency in GDs & interviews.
- Project desirable soft skills to interface the corporate.

**Course Content****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, “English for Competitive Examinations”, Macmillian Publishers, India, 1989, ISBN: 9780333925591
2. Devadoss K. & Malathy P., “Career Skills for Engineers”, National Book Publishers, Chennai, 2013.
3. Aggarwal R.S., “A Modern Approach to Verbal & Non–Verbal Reasoning”, S.Chand Publishers, India, 2012, ISBN : 8121905516



**Course Objectives**

- Students in the form of group not exceeding 3 members in a group to carry out their mini project. It can be a measurement project, mechatronic project or computer based simulation work. The interdisciplinary projects will carry more weightage. It is highly desirable to publish their project in state/ national level conferences or symposiums.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Design, and realize a simple mechanical/electrical/electronic/mechatronic system.
- Use various sensors, actuators and controllers.
- Work in a team with a confined time duration.
- Disseminate his work both in oral and written format.

**MARK SPLIT UP FOR MINI PROJECT 1**

<b>S.NO.</b>	<b>PARAMETER</b>	<b>% OF MARKS</b>
1.	Interdisciplinary work	10
2.	Publication	10
3	Working model/ simulation result	40
4	Innovation	30
5	Report with good referencing	10



## **U13GHP601 HUMAN EXCELLENCE NATIONAL VALUES**

(Common to all branches of Engineering and Technology)

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### **Course Objectives**

- To produce responsible citizens.
- To uphold our culture and spiritual life.
- To realize the value of unity, service.
- To immunize the body.
- To get Divine peace through inward travel.

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Acquire knowledge on the Enlightened Citizenship.
- Demonstrate skills required for the Indian Culture and it's greatness.
- Behave as responsible Great spiritual Leaders.
- Analyze National Values identification and practice.

### **Course Content**

#### **RIGHTS AND RESPONSIBLE CITIZENSHIP**

**5 Hours**

Citizenship- its significance-Enlightened citizenship - what are the rights to citizenship  
Emerging India-its glory today- Global perspective

#### **GREATNESS OF INDIAN CULTURE**

**5 Hours**

Outsiders view about India – about yoga - culture – joint family – morality – service - food– behavior – attitude – work.  
Indian culture and it's greatness – dress coding - festivals – food is medicine – games – traditional medicines

#### **INDIA AND PEACE**

**5 Hours**

India and Peace – who are the person to participate world peace - India and Spirituality- Great spiritual leaders – Shankarar – Ramanujar – mathvar – budha – mahaveerar – vallalar – Ramakrishna paramahamsar –mathaamirthananthamaayi – ramanar – aravindhar – annai.

#### **INDIA'S MESSAGE TO THE WORLD**

**5 Hours**

India's message to the world – thiruvalluvar – thirukural – manivasagar – tiruvasagam – aravindhar – B.K.S Iyengar – yoga asanas – Sir C.V.Raman – Physics –ramanujam – maths – rabinthranathtagore – literature – A.P.J Abdulkalam.

#### **GLOBAL PEACE**

**3 Hours**

It's role in global peace - – vethathiri maharishi – world peace –Thiruvalluvar – vallalar - Service and sacrifice-Unity in diversity – case studies-live examples - National values identification and practice.

#### **MEDITATION & YOGASANAS**

**7 Hours**

Nine Centre Meditations – Introduction – practice – benefits.  
Yogasanas - II



**REFERENCES:**

1. Vethathiri Maharishi, “World peace plane”
2. Swami Vivekananda, “Prosperous India”
3. Vethathiri Maharishi, “SamudhayachikkalukkananalaAaivugal”
4. Vethathiriyam, “World Community Life”



# SEMESTER VII

*24 May*



### **Course Objectives**

- To understand the basics of drives and power transmission system.
- To learn about the kinematics of robot
- To understand the basics of sensors and the different types of robotic End Effectors
- To learn about the machine vision systems and its application
- To gain information about the different types of robot programming methods.

### **Course Outcomes:**

**After successful completion of this course, the students should be able to**

- Explain the basics of robots , drives and power transmission system.
- Solve and analyse kinematics of robotic manipulator.
- Illustrate different sensors and robotic end effectors
- Explain the basics of machine vision and their operation.
- Program robots using different programming methods.

### **Course Content**

#### **INTRODUCTION**

**5Hours**

Basic Structure, Classification of robot and Robotic systems, laws of robotics, work space and precision of movement. Drives and control systems - Robot drive mechanisms- hydraulic – electric – servomotor- stepper motor - pneumatic drives. Control systems for robot.

#### **KINEMATICS OF ROBOT MANIPULATOR:**

**10Hours**

Introduction to manipulator kinematics, homogeneous transformations and robot kinematics, Denavit-Hartenberg (D-H) representation, concept of forward and inverse kinematics.

#### **SENSORS AND ROBOT END EFFECTORS**

**10Hours**

Sensors in robotics -Position sensors, Velocity sensors, Acceleration Sensors, Force/Torque sensor, Touch and Tactile sensors, Proximity, Range and sniff sensors, RCC and IRCC systems, VOICE recognition and synthesizers. Robot End Effectors - Types of end effectors, Mechanical grippers – Types of Gripper mechanisms – Grippers force analysis, other types of Grippers – Vacuum cups – Magnetic Grippers – Adhesive Grippers, Active and passive grippers, Robot end effector interface.

#### **MACHINE VISION**

**10Hours**

Image Sensing and Digitizing - Image definition, Image acquisition devices – videcon camera and digital camera, specialized lighting techniques. Digital Images - Sampling, Quantization and Encoding. Image storage. Image Processing and Analysis - Data reduction – digital conversion and windowing. Segmentation – Thresholding, Edge detection and Region growing. Binary Morphology and grey morphology operations. Feature Extraction, Object recognition, Depth measurement. Application of Vision systems.



## **ROBOT PROGRAMMING**

**10Hours**

**Robot programming:** Introduction; On-line programming: Manual input, lead through programming, teach pendant programming; Off-line programming languages, Simulation.

**Case studies:** Material transfer, Machine loading, Assembly, inspection, processing operations and service robots, Mobile Robots, biologically inspired robotics, Medical applications, and Space applications.

**TotalHours:45**

### **REFERENCES:**

- 1 S. R. Deb and S. Deb, „Robotics Technology and Flexible Automation“, Tata McGraw Hill Education Pvt. Ltd, 2010.
- 2 Saeed B. Niku, „Introduction to Robotics“,Prentice Hall of India, 2<sup>nd</sup> Edition 201.
- 3 Mikell P. Groover, "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.
- 4 Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India P Ltd., 2006.
- 5 Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987
- 6 Ramesh Jam, Rangachari Kasturi, Brain G. Schunck, Machine Vision, Tata McGraw-Hill, 1991.
- 7 Yoremkoren, Robotics for Engineers, McGraw-Hill, USA, 1987.
- 8 P.A. Janaki Raman, Robotics and Image Processing, Tata McGraw-Hill, 1991.



### **Course Objectives**

- To study the basics of electronics, emission controls and its importance in automobiles
- To study the various sensors and actuators used in automobiles for improving fuel economy and emissions
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.
- To study the chassis electrical systems, comfort and safety systems in the automobiles for the safety of vehicle users.

### **Course Outcomes:**

**After successful completion of this course, the students should be able to**

- Describe the importance of emission standards and electronics in automobiles.
- Identify; select the sensors and actuators used in automobiles for improving fuel economy and also in reduction of emissions.
- Compare the different types of ignition systems, injection systems used in automobiles.
- Explain the different control modes of engine management, networking in vehicles, comfort and safety systems in automobiles

### **Course Content**

#### **INTRODUCTION**

**9 Hours**

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Charging systems – working and design of charging circuit diagram – starter motors and starter circuits.

#### **BASICS OF ENGINES**

**9 Hours**

Operating principles of IC engine – major engine components – engine cylinder arrangements – the ignition systems – Electronic ignition, direct ignition, injection systems – working of the carburetor – throttle body injection – Multipoint fuel injection – sequential fuel injection.

#### **SENSORS AND ACTUATORS**

**9 Hours**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

#### **ENGINE CONTROL SYSTEMS**

**9 Hours**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system – In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.



## **CHASSIS, COMFORT AND SAFETY SYSTEMS**

**9 Hours**

Traction control system – Cruise control system– electronic control of automatic transmission antilock braking system – electronic suspension system –airbag systems – centralized door locking system – Navigation systems – climate control of cars.

**CASE STUDIES: Design of the Passenger comfort and safety systems.**

**Total Hours :45**

### **REFERENCES:**

1. TOM DENTON, “Automobile Electrical and Electronics Systems”, Edward Arnold Publishers, 2004.
2. William B. Ribbens, “Understanding Automotive Electronics”, Newnes Publishing, 5th edition, 2003.
3. “BOSCH Automotive Handbook –”, Bentley publishers 6th edition, 2005.
4. Barry Hollembeak, “Automotive Electricity, Electronics & Computer Controls”, Delmar Publishers, 2001.
6. “Fuel System and Emission controls”, Check Chart Publication, 2000.
7. Ronald. K. Jurgon, “Automotive Electronics Handbook”, McGraw-Hill, 1999.



**U13MCT703 MICRO ELECTRO MECHANICAL  
SYSTEMS**

**L T P C  
3 0 0 3**

**Course Objectives**

- To study about micro sensors and actuators.
- To study about fabrication process
- To design micro systems.

**Course Outcomes:**

**After successful completion of this course, the students should be able to**

- List the different scaling laws used in micro system design.
- Describe the various working principles of microsensor and microactuators.
- Summarize various micro system fabrication techniques.

**Course Content**

**INTRODUCTION**

**9 Hours**

Overview-Microsystems and microelectronics -definition-MEMS materials-scaling laws scaling in geometry-scaling in rigid body dynamics- scaling in electrostatic forces- scaling in electricity- scaling in fluid mechanics- scaling in heat transfer.

**MICRO SENSORS AND ACTUATORS**

**9Hours**

Working principle of Microsystems - micro actuation techniques - micro sensors- types -Microactuators – types – micropump – micromotors – micro – valves – microgrippers –micro Accelerometers

**FABRICATION PROCESS**

**9 Hours**

Substrates-single crystal silicon wafer formation-Photolithography-Ion implantation-Diffusion –Oxidation-CVD-Physical vapor deposition-Deposition by epitaxy-etching process

**MICRO SYSTEM MANUFACTURING**

**9Hours**

Bulk Micro manufacturing- surface micro machining –LIGA-SLIGA-Micro system packaging-materials-die level-device level-system level-packaging techniques-die preparation-surface bonding-wire bonding-sealing

**MICRO SYSTEM DESIGN**

**9Hours**

Design considerations-process design-mask layout design- mechanical design-applications of micro systems in automotive industry, bio medical, aero space and telecommunications.

**TotalHours:45**

**REFERENCES:**

1. Tai-Ran Hsu, “MEMS & Microsystems Design and Manufacture”, Tata McGraw-Hill,2006.
2. Mohamed Gad-el-Hak, “The MEMS Hand book”, CRC press 2005.
3. Julian W.Gardner,Vijay K.Varadan,Osama O.Awadel Karim, “Microsensors MEMSand Smart Devices”, John Wily & sons Ltd.,2001.



4. S.Fatikow,U.Rembold, “Microsystem Technology and Microrobotics”,Springer-Verlag Berlin Heidelberg ,1997.
5. Francis E.H Tay and W.O Choong, “Microfluidics and BioMEMS Applications”, Springer, 2002.

A handwritten signature in black ink, appearing to read 'W. O. Choong'.

**Course 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:**

**After successful completion of this course, the students should be able to**

- Understand the ethical theories and concepts
- Understanding an engineer's work in the context of its impact on society
- Understand and analyze the concepts of safety and risk
- Understand the professional responsibilities and rights of Engineers
- Understand the concepts of ethics in the global context

**Course Content****ENGINEERING ETHICS AND THEORIES****9Hours**

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 9Hours**

Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

**SAFETY****9Hours**

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****9Hours**

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****9Hours**

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.

**Total Hours :45**

**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.





**Course Objectives**

- To study about the different types of robot
- To program the robot using different sensors
- To program an industrial robot using a machine vision system
- To simulate a robot using the robotics simulation software.

**Course Outcomes:**

**After successful completion of this course, the students should be able to**

- Work with different types of robots.
- Control mobile robots using different sensors and actuators.
- Manipulate an industrial robot using a machine vision system and HMIs.
- Handle a robot model using the robotics simulation software.
- Analyze and present the findings of experimental observations in both written and oral format.

**Course Content****LIST OF EXPERIMENTS**

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Modeling Forward and inverse kinematics for robotic arm using Mathematical Software
5. Offline programming of an Industrial robot using Robotics simulationSoftware
6. Setup and program a station with conveyor tracking using the Robotics simulation Software
7. Vision-Based Control On an Industrial Robot
8. Writing and verifying a Program for point to point operations for mobile robots
9. Obstacle Avoidance of a mobile robot with Ultrasonic Sensor
10. Tilt sensing for an autonomous mobile robot
11. Line following robot

**Total Hours:45**



**Course Objectives**

- To study about PLC ladder logic programming
- To Manipulate data using PLC instruction sets.
- To Write motion control programs
- To design and Configure graphical screens for HMI (Human Machine Interface) in LabVIEW

**Course Outcomes:**

**After successful completion of this course, the students should be able to**

1. Use different sensors and actuators to control various industrial parameters : temperature, pressure, level and flow.
2. Write program for PLCs and Labview to interface and control various actuators.
3. Simulate and create virtual instruments.
4. Analyze and present the findings of experimental observations in both written and oral format.

**Course Content****I PROCESS CONTROL**

1. Closed loop response of level control loop.
2. Closed loop response of flow control loop.
3. Closed loop response of temperature control loop.
4. Closed loop response of pressure control loop.

**II PROGRAMMABLE LOGIC CONTROLLER**

1. Simulation exercises.
2. Traffic light control.
3. Stepper motor control.
4. DC motor control.
5. Relay testing.

**III LAB VIEW SIMULATIONS**

1. Programming exercises using loops and charts.
2. Programming exercises using clusters and graphs
3. Programming exercises using case and sequence structures, file input/output, string operations.
4. Creating virtual instrumentation for simple applications.

**TotalHours :45**



**Course Objectives**

- Students in the form of group not exceeding 3 members in a group to carry out their mini project. It can be a measurement project, mechatronic project or computer based simulation work. The interdisciplinary projects will carry more weightage. It is highly desirable to publish their miniproject in state/ national level conferences or symposiums.

**Course Outcomes****After successful completion of this course, the students should be able to**

- Design, analyze, realize/simulate a physical system by using the technology they learnt during three years of the programme.
- Integrate various systems into one mechatronic product.
- Work in a team with a confined time duration.
- Disseminate his work both in oral and written format.

**MARK SPLIT UP FOR MINI PROJECT 2**

S.NO.	PARAMETER	% OF MARKS
1.	Interdisciplinary work	10
2.	Publication	15
3	Working model/ simulation result	35
4	Innovation	30
5	Report with good referencing	10



**U13GHP701**

**HUMAN EXCELLENCE GLOBAL  
VALUES**

**L T P C**

**1 0 1 1**

(Common to all branches of Engineering and Technology)

**Course Objectives**

- To realize global brotherhood and protect global.
- To know the youths participation in politics.
- To know importance of retain of our culture and Maintain
- To know impact of global terrorism.
- To know the current economic status among the youths.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Behave as responsible human beings respecting the global values.
- Acquire knowledge on the complex patterns involved in maintaining world's peace and ecological balance.
- Demonstrate skills required for the emergency of mono-culture at the global level.
- To learn about Man is the cause and Man is the solution.

**Course Content**

**GLOBAL BROTHERHOOD AND PROTECT GLOBE**

**5 Hours**

Global values – understanding and identification – its importance - Racial discrimination and solution

**MAN IS THE CAUSE AND MAN IS THE SOLUTION**

**5 Hours**

Ecological imbalance – global warming – rain fall – status – acid rain – plastic usage – control - Political upheavals – nowadays political status – basic rights to citizen – corruption – youths participate in politics –e.g: M.K.Stalin – Kanimozhi – ragul Gandhi.

**GREATNESS OF CULTURE**

**5 Hours**

Social inequality and solution– live case discussions and debate – black money – poverty people - Cultural degradation– live case discussions and debate – difference between Indian culture & western culture – impact of western culture in India – how to retain our culture and solution.

**EMERGENCE OF MONOCULTURE**

**4 Hours**

Emergence of monoculture – solution - Global terrorism – it's cause and effect – solution –

**MARGINALIZATION OF GLOBAL ECONOMIC**

**4Hours**

Economic marginalization and solution – it's impact in the globe – globalization in market – its effect in local market – merits – demerits of globalization - Man is the cause and man is the solution.



## **MEDITATION & YOGASANAS**

**7 Hours**

Nithyananda Meditation & Divine Meditation – Introduction – practice – benefits.  
Yogasanas - III

**Total Hours :30**

### **REFERENCES :**

1. Vethathiri Maharishi, “World peace plane”
2. Swami Vivekananda, “Prosperous India”
3. Vethathiri Maharishi, “SamudhayachikkalukkananalaAaivugal”
4. Vethathiri Maharishi, “World Community Life”



# SEMESTER VIII

*24.10.11*

**Course Objectives**

- Students in the form of group, not exceeding 3 members in a group to carry out their main project. It should be a mechatronic project. However, special considerations can be given for interdisciplinary measurement and computer based simulation projects. This exception should be recorded and approved by the department committee. Management related project projects will not be allowed. The interdisciplinary projects will carry more weightage. It is mandatory to publish their main project in national/international level conferences to appear in the viva-voce exam.

**Course Outcomes****After successful completion of this course, the students should be able to**

- Design, analyze, realize/simulate a physical system by using the technology they learnt during the programme.
- Integrate various systems into one mechatronic product.
- Work in a team with a confined time duration.
- Disseminate his work both in oral and written format.

**MARK SPLIT UP FOR MAIN PROJECT**

S.NO.	PARAMETER	% OF MARKS
1.	Interdisciplinary work	10
2.	Publication	25
3	Working model/ simulation result	25
4	Innovation	30
5	Report with good referencing	10



**Course 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:**

**After successful completion of this course, the students should be able to**

- Apply linear programming model and assignment model to domain specific situations
- Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
- Apply the concepts of PERT and CPM for decision making and optimally managing projects
- Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions
- Analyze the inventory and queuing theories and apply them in domain specific situations

**Course Content****LINEAR MODEL****9Hours**

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****9Hours**

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****9Hours**

Basic terminologies – Constructing a project network – Scheduling computations – PERT – CPM – Resource smoothening, Resource leveling, PERT cost.

**REPLACEMENT AND SEQUENCING MODELS****9Hours**

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**

**9Hours**

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/ $\infty$ / $\infty$  - M/M/1: FCFS/n/ $\infty$  - M/M/C: FCFS/ $\infty$ / $\infty$  - M/M/1: FCFS/n/m

**Total Hours:45**

### **REFERENCES:**

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



**Course Objectives**

- To understand the principles involved in discretization and finite element approach
- To learn to form stiffness matrices and force vectors for simple elements

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Develop the governing equations for a continuum.
- Model and assemble the stiffness matrices for 1D, 2D elements.
- Choose the appropriate element type for a particular application.
- Apply the FEM for plate bending and thermal analysis.

**Course Content****INTRODUCTION****9Hours**

Historical background – Introduction to FEA – Review of Matrix Algebra and Gaussian elimination – Governing equations for continuum – Spring assemblage – Stiffness method & Potential Energy Approach – Galerkin's weighted residual method

**ONE DIMENSIONAL ELEMENTS – BAR, PLANE TRUSS & BEAM****9Hours**

Bar element - Stiffness Matrix in local and global coordinates, Computation of Stress – Potential Energy and Galerkin's residual method – Solution of Plane Truss – Beam element – Stiffness and assembly of stiffness matrices - Potential energy and Galerkin's approach

**PLANE STRESS & PLANE STRAIN – CST & LST APPROACH****8Hours**

Basic concepts of plane stress & plane strain – Constant Strain Triangle approach – Stiffness Matrix and Equations - Body & Surface Forces – FE solution for plane stress problem – Practical Considerations in Modeling (Qualitative treatment) – Linear Strain Triangle approach - Stiffness Matrix and Equations

**AXISYMMETRIC ELEMENTS&ISOPARAMETRIC FORMULATION****10 Hours**

Axisymmetric formulation – Stiffness Matrix – Pressure Vessel Analysis – Applications – Isoparametric formulation – Formulation for Bar and Plane Elements – Numerical Integration – Gaussian & Newton-Cotes Quadrature – Evaluation of Stiffness Matrix by Gaussian Quadrature

**PLATE BENDING AND THERMAL ANALYSIS****9Hours**

Basic Concepts of Plate Bending – Element Stiffness Matrix and Equations – Heat Transfer – Basic Differential Equation and Units – 1d and 2d formulation

**CASE STUDIES: Finite Element Analysis on Bicycle Frame, Finite Element Analysis on V-belt pulley of a fodder crushing machine**

**Total Hours: 45**

**REFERENCES:**

1. Daryl, L. Logan, “A First course in the Finite Element Method”, Thomson Learning, 4<sup>th</sup> edition, 2007.
2. Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education, 3<sup>rd</sup> Edition, 2002.
3. David V Hutton “Fundamentals of Finite Element Analysis”, McGraw-Hill International Edition, 2004.
4. Rao S.S., The Finite Element Method in Engineering, Pergammon Press, 1989.
5. J. N. Reddy, “An Introduction to the Finite Element Method”, , Tata McGraw Hill, 3<sup>rd</sup> Edition 2005.



**U13GST005      ENGINEERING ECONOMICS AND  
FINANCIAL MANAGEMENT**

**L T P C  
3 0 0 3**

**Course 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**

**After successful completion of this course, the students should be able to**

- Evaluate the economic theories, cost concepts and pricing policies.
- Understand the market structures and integration concepts.
- Understand the measures of national income, the functions of banks and concepts of globalization.
- Apply the concepts of financial management for project appraisal
- Understand accounting systems and analyze financial statements using ratioanalysis.

**Course Content**

**ECONOMICS, COST AND PRICING CONCEPTS**

**9Hours**

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**

**9Hours**

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

**NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT**

**9Hours**

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**

**9Hours**

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital



## **ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS**

**9Hours**

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance  
– Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

**TotalHours:45**

### **REFERENCES:**

1. Prasanna Chandra, “ Financial Management (Theory & Practice)”.
2. Weston & Brigham, “ Essentials of Managerial Finance”.
3. Pandey, I. M., “Financial Management”.
4. James C. Van Horne , “Fundamentals of Financial Management”.
5. James C. Van Horne , “Financial Management & Policy”.
6. M. Y. Khan & P. K. Jain , “Management Accounting & Financial Management”.
7. P. Saravanavel , “Management Accounting Principles & Practice”.



## **U13MCE102 PLANT LAYOUT AND MATERIAL HANDLING**

**L T P C**  
**3 0 0 3**

### **Course Objectives**

- To study of location on plant layout, selection of plant site, consideration in facilities planning and layout.
- To study about the tool and techniques for developing layout.
- To study about the industrial buildings and utilities material handling
- To study designing of material handling systems

### **Course outcomes**

**After successful completion of this course, the students should be able to**

- Identify the location for plant site and also prepare the requirements for the operation of plant.
- Plan and prepare layout for various process lines in the plant.
- Describe the importance of material handling systems and factors influencing in the selection of material handling systems.
- Design and analyze the material handling system.
- Suggest the material handling system in terms of economy and safety.

### **Course Content**

#### **PLANT LOCATION AND PHYSICAL FACILITIES**

**9Hours**

Factors to be considered – Influence of location on plant layout, selection of plant site, consideration in facilities planning and layout – Equipment required for plant operation, Capacity, Serviceability and flexibility and analysis in selection of equipments, space and man power requirements.

#### **PLANT LAYOUT**

**9Hours**

Need for layout, types of layout, factors influencing product, process, fixed and combination layout, tool and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models – machine data. Layout planning procedure – visualization of layout, revision and improving existing layout, balancing of fabrication and assembly lines.

#### **INDUSTRIAL BUILDINGS AND UTILITIES**

**9 Hours**

Centralized electrical, pneumatic, water line systems. Types of buildings, lighting, heating, air-conditioning and ventilation utilities – planning and maintenance, waste handling, statutory requirements, packing and storage of materials: Importance of packaging, layout for packaging – packaging machinery – wrapping and packing of materials, cushion materials.

#### **MATERIAL HANDLING**

**9Hours**

Importance and Scopes – Principles of material handling – engineering and economic factors - planning, relationship to plant layout – types and selection of material handling systems, factors influencing their choice – concept of containerization and palletization.



## **ANALYSIS OF MATERIAL HANDLING**

**9Hours**

Factors involved – motion analysis, flow analysis, graphical analysis, safety analysis, equipment cost analysis, palletization analysis, analysis of operation, material handling surveys – Designing of material handling systems – System equation - Planning chart, Unit load design – principle - efficiency of containers, pallet sizes.

### **CASE STUDIES:**

**Improvements in material handling in cement manufacturing industry, Design of a final assembly plant in an automobile industry, development of material tracking system for food packaging industry.**

**TotalHours: 45**

### **REFERENCES:**

1. Khanna, O. P., “Industrial Engineering and Management”, Dhanpatrai and Sons, 2003.
2. Apple, James M. Plant Layout and Material Handling,. John Wiley and Sons, New York, 3<sup>rd</sup> edition, 1977.
3. Fred E Meyers, “Plant Layout and Material Handling”, Prentice Hall, 2<sup>nd</sup> edition, 1999.
4. James A. Tompkins , John A. White, Yavuz A. Bozer and J. M. A. Tanchoco “Facilities Planning”, John Wiley & Sons, 3<sup>rd</sup> edition, 2003.
5. Govindan, K. R., “Plant Layout and Material Handling”, Anuradha, Kumbakonam, 2001.



**Course Objectives**

- To explain the basic concepts of building a model, study of simulation and systems
- To study about the generation of random numbers, testing of random numbers
- To study about the generation of random variables
- To study the concepts of analysis and evaluation of models
- To study about various simulation soft wares

**Course Outcomes:**

**After successful completion of this course, the students should be able to**

- Define the simulation and its importance in creation of models for real time systems.
- Describe the different types of systems.
- Simulate the real time systems by generating the random numbers and variables.
- Design and analyze the model using simulation software packages.

**SYSTEM AND SYSTEM ENVIRONMENT****9 Hours**

Component of a System – Continuous and discrete systems – Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queue – inventory system.

**RANDOM NUMBER GENERATION****9 Hours**

Properties of random numbers – Generation of Pseudo – random numbers – techniques of generating pseudo random numbers; Test for random numbers: the Chisquare test-the kolmogrov Smirnov test – Runs test – Gap test – poker test.

**RANDOM – VARIATE GENERATION****9 Hours**

Inverse transform technique for Exponential, Uniform, triangular, weibull, empirical, uniform and discrete distribution, Acceptance rejection method for Poisson and gamma distribution; Direct Transformation for normal distribution.

**ANALYSIS AND EVALUATION OF MODEL****9 Hours**

Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

**SIMULATION SOFTWARE PACKAGES****9Hours**

Comparison and selection of General Purpose Simulation System (GPSS) , SIMSCRIPT, SLAM, Arena simulation language, Modeling basic operations using Arena – An Electronic Assembly and testing system, Development of simulation models using Arena simulation package for queuing system, Production system, inventory system, Arena Integration and customization. Simulation Case Study of a Metal-Parts Manufacturing Facility

**Total Hours: 45**



## REFERENCES :

1. Banks J., Carson J.S. and Nelson B.L., “Discrete – Event System Simulation”, , Pearson Education, Inc 3<sup>rd</sup> Edition, 2005
2. David Kelton.W. and Randall P. Sowdowski, “Simulation with Arena”, , McGraw Hill, 2<sup>nd</sup> Edition, 2002.
3. Geoffrey Gorden, “System Simulation”, Prentice Hall of India, 2003.
4. Narsingh Deo., “System Simulation with Digital Computer”, Prentice Hall of India, 2003.



**U13MCE202**

**PRODUCTION PLANNING AND  
CONTROL**

**L T P C**

**3 0 0 3**

(Common to Mechanical and Mechatronics Engineering)

**Course Objectives**

- To understand the components and functions of production planning and control
- To understand Work study methodology
- To understand Product planning, process planning and process capabilities
- To understand Production scheduling
- To understand Inventory Control.

**Course Outcomes:**

**After successful completion of this course, the students should be able to**

- Define and summarize the production facilities along with proper systematic planning of production activities.
- Explain and apply various assessing method of working such as to achieve maximum output and efficiency.
- Compare and select the optimum process for the production, along with process steps and production capacity.
- Comprehend and solve basic problems that arise in scheduling and inventory in a production process.

**Course Content**

**INTRODUCTION**

**9 Hours**

Objectives and benefits of planning and control-Functions of production control-Types of production – job – batch and continuous – Product development and design-Marketing aspect - Functional aspects-Operational aspect- Durability and dependability aspect-aesthetic aspect. Profit consideration- Standardization, Simplification &specialization-Break even analysis – Economics of a new design.

**WORKSTUDY**

**9 Hours**

Method study, basic procedure-Selection-Recording of process – Critical analysis ,Development – Implementation – Micromotion and memomotion study – work measurement – Techniques of work measurement-Time study-Production study- Work sampling-Synthesis from standard data-Predetermined motion time standards.

**PRODUCTPLANNINGANDPROCESSPLANNING**

**9 Hours**

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing- Pre requisition formation needed for process planning – Steps in process planning-Quantity determination in batch production-Machine capacity, balancing.

**PRODUCTIONSCHEDULING**

**9 Hours**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problem's - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing-ProductionControlsystems-Periodicbatch control-Material requirement planning kanban



–Dispatching-Progress reportingandexpediting – Manufacturingleadtime –  
Techniquesforaligning completiontimesanddue dates.

## **INVENTORY CONTROL AND RECENT TRENDS IN PPC 9Hours**

Inventory control-Purpose of holding stock-Effect of demand on inventories-  
Ordering procedures. Two bin system – Ordering cycle system –  
Determination of Economic order quantity and economic lot size-ABC analysis-  
Recorder procedure – Introduction to computer integrated production planning systems-  
elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP, Lean  
Manufacturing.

### **CASE STUDIES: Shop floor Management**

**Total Hours: 45**

### **REFERENCES:**

1. Martand Telsang, “Industrial Engineering and Production Management”,  
S.Chand and Company, 2<sup>nd</sup> Edition, 2006.
2. Samson Eilon, “Elements of production planning and control”, Universal Book Corpn  
.1984.
3. Elwood S. Buffa, and Rakesh K. Sarin, “Modern Production /  
Operations Management”, 8<sup>th</sup> Ed. John Wiley and Sons, 2000.
4. K.C. Jain & L.N. Aggarwal, “Production Planning Control and  
Industrial Management”, Khanna Publishers, (1990) reprint 2002.
5. N.G. Nair, “Production and Operations Management”, Tata McGraw-Hill, 1996.
6. S.N. Chary, “Theory and Problems in Production & Operations Manage  
ment”, Tata McGraw Hill, 1995.
7. S.K. Hajra Choudhury, Nirjhar Roy and A.K. Hajra Choudhury,  
“Production Management”, Media Promoters and Publishers Pvt. Ltd., 1998.



**Course 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**

**After successful completion of this course, the students should be able to**

- Differentiate product design and process design.
- Develop ideas for creating new products by selecting the appropriate parts.
- Apply the different laws of appearance in the product design.
- Analyse the products in terms of cost, appearance and quality by applying the value engineering concept.

**Course Content****INTRODUCTION -DEVELOPMENT PROCESSESAND RGANIZATIONS  
- PRODUCT PLANNING****9Hours**

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 SPECIFICATION****9Hours**

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****9Hours**

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**

**9Hours**

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**

**9Hours**

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 Hours:45**

### **REFERENCES:**

1. Karl. T. Ulrich, Steven D Eppinger,. Irwin, "Product Design and Development" McGrawHill.
2. A C Chitale and R C Gupta, "Product Design and Manufacturing", PHI.
3. Timjones. Butterworth Heinmann,"New Product Development" Oxford. UCL.
4. Geoffery Boothroyd, Peter Dewhurst and Winston Knight "Product Design for Manufacture and Assembly".



**Course Objectives**

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques.
- To study the image compression procedures.
- To study about color image processing and wavelets.
- To study the image segmentation and representation techniques.

**Course Outcomes:**

**After successful completion of this course, the students should be able to**

- Summarize acquisition and processing methods of digital image along with their applications.
- Design filters for image enhancement.
- Compare image enhancement in spatial domain with frequency domain.
- Choose appropriate image compression and segmentation techniques for different applications.

**Course Content****DIGITAL IMAGE FUNDAMENTALS****9 Hours**

Introduction – Examples of fields that use Digital image processing, Fundamental steps in Digital Image Processing systems, Components of an image processing systems, Light and EM spectrum, Image sensing and acquisition, Image sampling and quantization- Concepts, image representation, Spatial and gray level resolution, Aliasing and Moiré patterns, Some basic relationships between pixels.

**IMAGE ENHANCEMENT IN SPATIAL DOMAIN****9 Hours**

Background, Gray level transformation- Image negatives, Log transformations, Power law transformations, Piecewise – Linear transformation functions, Histogram processing – Histogram equalization, Histogram matching (Specifications), Enhancement using ALU.

**IMAGE ENHANCEMENT IN FREQUENCY DOMAIN****9 Hours**

Introduction to the Fourier transform and the frequency domain – 1-D Fourier transform and its inverse, 2-D Fourier transform and its inverse, Smoothing frequency domain filters- Ideal, Butterworth, Gaussian lowpass filters, Sharpening frequency domain filters- Ideal, Butterworth, Gaussian highpass filters.

**COLOR IMAGE PROCESSING AND WAVELETS****9 Hours**

Color fundamentals, Color models- RGB color model, CMY and CMYK color model, HIS color model. Wavelets- Background- Image pyramids, subband coding, Haar transform, Wavelet transform in 1-D- Wavelet series expansion, discrete wavelet transform, Continuous wavelet transform.

## **IMAGE COMPRESSION AND SEGMENTATION**

**9 Hours**

Fundamentals–Image compression models, Error-free compression–  
Lossy compression–Lossy predictive coding, Transform coding, JPEG2000 – Detection of  
discontinuities – Edge linking and boundary detection.

**CASE STUDIES: Optimization of Image Processing Algorithms**

**Total Hours: 45**

### **REFERENCES:**

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education Asia/Addison Wesley publishing company, 6th Indian Reprint, 2008.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall of India, New Delhi, 2001.
3. Maher A. Sid-Ahmed, “Image Processing Theory, Algorithms and architectures”, McGraw-Hill, 1995.
4. William K. Pratt, “Digital Image Processing”, Wiley-Inter Science Publication, 2nd Edition, 1991.
5. Arthur K Weeks, “Fundamentals of Electronics Image Processing”, Prentice-Hall of India, New Delhi, 2001.



## U13MCE204 STATISTICAL QUALITY CONTROL

L T P C

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### Course Objectives

- To Study on sampling procedures.
- To Study the application of control charts to measure.
- To Study the improvement of the quality of products and processes.

### Course Outcomes:

**After successful completion of this course, the students should be able to**

- Define the concept of probability, and also the various sampling method to measure quality and the attributes of quality.
- Summarize the process behaviour based on various control charts.
- Select the appropriate samples for the study.
- Apply various techniques to improve the overall quality.

### Course Content

#### INTRODUCTION

**7Hours**

Probability concepts, Review of distribution: Normal, Poisson's, and Binomial, Problems, Measuring of quality and control, Value and quality, Quality costs, Quality assurance.

#### CONTROL CHARTS FOR VARIABLES

**10 Hours**

Chance and assignable causes of quality variation, Control charts for variables, X-bar, R, and -charts, Warning and modified control limits, Process capability study, Ranges, Moving Averages, and Six  $\sigma$ - limits, multivariate charts.

#### CONTROL CHARTS FOR ATTRIBUTES

**8 Hours**

Limitation of variable chart, p-chart, problems with variable sample size, np-chart, c- chart, u-chart, and ku-chart, Demerits per unit control chart.

#### ACCEPTANCE SAMPLING

**10Hours**

Economics of sampling, Lot formation, OC-Curve-Producer's and Consumer's risk, Single and double sampling plans, AOQ, AOQL, ATI, ASN, Sequential sampling plan, MIL – STD – 1050 tables, MIL – STD – 414 tables, IS 2500 Standard.

#### QUALITY IMPROVEMENT

**10Hours**

Zero defects program, Quality circle, Fishbone diagram, scatter diagram, Pareto Analysis, Deming cycle, Introduction to Reliability function, System reliability of series, parallel, and combined configurations, Reliability improvement techniques.

**Total Hours :45**

### REFERENCES:

1. Grant E.L. and Leavensworth, "Statistical Quality Control", Tata McGraw-Hill Publishing Company, 5<sup>th</sup> edition 2002.
2. Douglas C. Montgomery, "Statistical Quality Control", John Wiley and Sons, 2001.





3. Fiegenbaum, A.V., “Total Quality Control”, McGraw-Hill Inc., 1991.
4. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publishers, New Delhi, 1998.
5. Srinath L.S “Reliability Engineering”, Affiliated East west Press, 1998.

A handwritten signature in black ink, appearing to be 'A. V. Fiegenbaum'.

**Course Objectives**

- To review background information required for studying virtual instrumentation.
- To study the basic building blocks of virtual instrumentation.
- To study the programming techniques.
- To study the data acquisition and instrument control in virtual instrumentation
- To study the various techniques of interfacing of external instruments of PC.
- To study a few applications in virtual instrumentation.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Describe the basic building blocks of virtual instrumentation.
- Use various functions to effectively develop programs.
- Demonstrate the various components involved in interfacing of different hardwares to the PC.
- Develop simple applications related to process automation and biomedical engineering.

**Course Content****INTRODUCTION****9 Hours**

Historical perspective of traditional benchtop instruments, Architecture of Virtual Instrumentation -Advantages of Virtual Instrumentation over conventional instruments - Sequencing - data flow- Graphical programming concept.

**SOFTWARE ENVIRONMENT****9 Hours**

Introduction to VI software - Front panel - Block diagram - Icon and Connector – Palettes -Creating, editing, wiring, debugging and saving VIs - sub-VIs - creating sub-VIs - simple examples - Looping: For loop, while loop - Shift registers.

**PROGRAMMING TECHNIQUES****9 Hours**

Case and sequence structures, formula nodes, Arrays-clusters, charts and graphs, local and global variables - property node, string and file I/O.

**DATA ACQUISITION AND INSTRUMENT CONTROL****9 Hours**

DAQ - Components - Buffers: Buffered and non buffered I/O – Triggering - Analog I/O, Digital I/O-Counters and timers-Instrument control: VISA, GPIB, PXI.

**APPLICATIONS OF VIRTUAL INSTRUMENTATION****9 Hours**

Process control- Physical- Biomedical- Image acquisition and processing.

**Total Hours : 45**

## REFERENCES:

1. Sanjeev Gupta, "*Virtual Instrumentation using Labview*" Tata McGraw Hill, 2010.
2. Gary Johnson, "*Lab view graphical programming*", II Ed., McGraw Hill, 4<sup>th</sup> edition 2006.
3. Lisa K Wells & Jeffrey Travels, "*Lab view for everyone*", Prentice Hall, 2003.
4. Jovitha Jerome "*Virtual Instrumentation using Lab View*" PHI Learning Pvt. Ltd, 2009.



**Course Objectives**

- will be introduced to various types of statistical analysis of data
- will be acquainted with construction of probabilistic model and control charts

**Course Outcomes****After successful completion of this course, the students should be able to**

- Compute measures of central tendencies, dispersions and correlate the variables.
- Analyze random or unpredictable experiments and investigate important features of random experiments.
- Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- Analyze sample data and interpret the same for population.
- Sketch the control charts and outline the process capability.

**Course Content****STATISTICAL MEASURES****9 Hours**

Measures of central tendency: Mean, Median and Mode – Measures of variation – Range, standard deviation, Mean deviation and coefficient of variation. Correlation and Regression: Karl Pearson's coefficient of correlation – Rank Correlation – Regression lines (Definitions and simple numerical problems only).

**PROBABILITY AND RANDOM VARIABLE****10 Hours**

Axioms of probability - Conditional probability - Total probability – Baye's theorem - Random variable - Probability mass function - Probability density function- moments –moment generating function- properties.

**STANDARD DISTRIBUTIONS****8 Hours**

Binomial, Poisson and Normal distributions – properties- Fitting of Binomial, Poisson and normal distributions to data.

**TESTING OF HYPOTHESIS****9 Hours**

Testing of hypothesis for large samples (single mean, difference of means, single proportion, difference of proportions) – Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence and goodness of fit - Simple numerical problems only.

**DESIGN OF EXPERIMENTS AND QUALITY CONTROL****9 Hours**

Analysis of variance – One way classification - Two – way classification – CRD - RBD - Latin square – LSD Concept of process control - Control charts for variables –  $\bar{X}$ , R – charts – Control charts for attributes – p, np, c – charts – Tolerance limits.

**Total Hours:45**

## REFERENCES

1. Veerarajan T., "Probability and Statistics", Tata McGraw-Hill, New Delhi, 2007
2. Gupta S. P., "Statistical Methods", Sultan Chand & Sons Publishers, 2004. (Unit - I)
3. Johnson R. A., "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Delhi, 6th Edition, 2000.
4. Gupta S.C. and Kapur J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, New Delhi, 9th Edition 1996.
5. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 2002.
6. Arunachalam T., "Probability and Statistics", Inder Publications, Coimbatore, 2008.



**Course Objectives**

- To understand the fundamental concepts of computational fluid dynamics.
- To study the various techniques involved in discretization of fluid elements.
- To gain knowledge in solving the fluid dynamics problems using finite element and finite volume methods.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Solve numerical equations related to fluid flow.
- Apply finite difference, finite volume and finite element methods to fluid flow problems.
- Describe the important classes of numerical discretisation scheme, and explain the relationship between the discretisation process and the underlying fluid physics.

**Course Content****FUNDAMENTAL CONCEPTS****10Hours**

Introduction - Basic Equations of Fluid Dynamics - Incompressible In viscous flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations - Elliptic, Parabolic and Hyperbolic equations - Well posed problems - discretization of partial Differential Equations - Transformations and grids - Explicit finite difference methods of subsonic, supersonic and viscous flows.

**PANEL METHODS****7Hours**

Introduction – Source panel method – Vortex panel method – Applications.

**DISCRETIZATION 8Hours**

Boundary layer Equations and methods of solution - Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation -- Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems - Further advantages of upwind differencing.

**FINITE ELEMENT TECHNIQUES****10Hours**

Finite Element Techniques in Computational Fluid Dynamics; introduction – Strong and Weak Formulations of a Boundary Value Problem - Strong formulation - Weighted Residual Formulation - Galerkin Formulation - Weak Formulation - Variational Formulation - Piecewise defined shape functions - Implementation of the FEM - The Solution Procedure.

**FINITE VOLUME TECHNIQUES****10Hours**

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Von Neumann Time Stepping - Runge - Kutta Time Stepping - Multi - stage Time Stepping - Accuracy

- Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques - Central and Up-wind Type Discretizations - Treatment of Derivatives.

**TotalHours:45**

## **REFERENCES**

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1991.
2. John F. Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992
3. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II. John Wiley & Sons, New York, 1988.
4. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II, Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 - 1078 USA, 1993.



**Course Objectives**

- To study the concepts of data communications.
- To study the functions of different layers.
- To introduce IEEE standards employed in computer networking.
- To make the students to get familiarized with different protocols and network components.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

1. Identify different types of network topologies and protocols.
2. Differentiate and explain the various layers of the OSI model and TCP/IP.
3. Identify the different types of data communication concepts and their functions within a network
4. Understand and building the skills of TCP/IP and internetworking.
5. Explain the importance of broad band networks and connectivity.

**Course Content****OPEN SYSTEM INTERCONNECTION MODEL****9 Hours**

Network Goals – uses – network topologies – Network architecture - OSI Reference model services – Network standardization – ARPANET – SNA – USENET

**DATA COMMUNICATION CONCEPTS****9 Hours**

Guided and unguided Medias – Asynchronous and synchronous transmission – RS 485 Ethernet - Fast Ethernet RS232C Interface, X.21 interface switching technologies – Circuit, Message, packet and hybrid switching – Elementary data link protocols – sliding window – Automatic repeat request.

**MEDIUM ACCESS SUB-LAYER AND NETWORK LAYER****9 Hours**

Channel allocation methods – ALOHA protocols – Pure ALOHA – Slotted ALOHA – local area networks – IEEE standard 802 for LANS – Wireless LAN IEEE 802.11 FDD1 - Virtual circuits – datagram – comparison – Routing congestion control.

**TCP/IP –AND INTERNETWORKING****9 Hours**

TCP/IP – architecture and operation – IP layers and functions – addressing and routing – Internet user services – E-Mail – w.w.w. - Internetworking – Bridges – Gateways – Repeaters – Routers – Brouters.

**BROAD BAND NETWORKS AND CONNECTIVITY****9 Hours**

ISDN Evolution – structures – Limitation - Broadband - ISDN, Transfer modes – Asynchronous transfer mode (ATM) – ATM cell format – Traffic Management – SONET – Introduction to VSAT networks.

**CASE STUDIES: OSI model in Controller area network (CAN) , TCP/IP Performance over Mobile Networks**



**REFERENCES:**

1. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall of India, 4<sup>th</sup> edition, 2002
2. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.
3. Dimetri Bertsekas and Robert Gallager, "Data Networks", PH1, 1994.
4. Hughes.L. "Data Communication a Practical Approach", Narosa Publications 1997.
5. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, 2003.
6. Larry L. Peterson and Peter S. Davie, "Computer Networks", Harcourt Asia Pvt. Ltd., Second Edition.



**Course Objectives**

- To study the basics of maintenance and reliability engineering, maintenance management, cost analysis and the techniques used for predictive maintenance.
- Students learn the principles of various maintenance technologies as they are currently practiced by industry

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Summarize the significance of maintenance, scheduling and their limitations.
- Explain the procedures used to extract data from machinery measurements for predictive maintenance.
- Describe the various vibration measuring techniques and vibration signature analysis used in rotating machineries.
- Demonstrate the principles of lubrication oil analysis and its use in predictive maintenance.
- Explain the basics of failure models and apply life prediction techniques as part of an equipment diagnosis

**Course Content****OVERVIEW OF MAINTENANCE AND RELIABILITY ENGINEERING****9 Hours**

Scope of industrial preventive/predictive maintenance programs - Definition of terminology- An example of establishing equipment maintenance program- Overview of condition-based maintenance technologies- Maintenance planning, management and designing an effective maintenance organization- Information systems organization and asset management - Evaluating maintenance performance- Cost-benefit analysis.

**DIGITAL SIGNAL PROCESSING (DSP) AND INFORMATION EXTRACTION FROM MACHINERY MEASUREMENTS****9Hours**

Instrumentation systems and measurements- Data acquisition from machinery sensors, data sampling- Signal conditioning: digital filters and signal preprocessing- Time-domain and frequency-domain signatures- Monitoring transients such as machinery start-up and coast-down events- Demonstration of a typical data acquisition and analysis system- **Case studies** of machinery monitoring for predictive maintenance.

**VIBRATION ANALYSIS AND ROTATING MACHINERY CONDITION MONITORING WITH CASE STUDIES****9Hours**

Vibration and its causes- Classification of frequency ranges- Imbalance, misalignment, looseness, bearing defects, and their characteristic frequencies- Understanding vibration of a second order system- Instrumentation for vibration monitoring- Description of a typical vibration monitoring system- Vibration signatures, data trending, and alarming techniques.



**Case studies of vibration monitoring:** turbine imbalance, pump misalignment, pump looseness, boiler feed water pump anti-friction bearing monitoring, pump journal bearing monitoring, rolling mill gearbox problem, transient vibration analysis.

## **LUBRICATION OIL ANALYSIS AND TRIBOLOGY**

**9Hours**

Scope of lubrication oil analysis- Classification of lube oil test methods - Lube oil degradation monitoring; demonstration of equipment - Lube oil contamination analysis- Lube oil wear particle analysis- Case studies of industrial applications.

## **RELIABILITY ENGINEERING AND FAILURE MODELS 9 Hours**

Reliability, availability and maintainability - Reliability models and failure distributions - Reliability function estimation - Residual life estimation as a prognosis activity- model development and forecasting

**Case studies** of applications to rotating machinery and heat exchangers.

**TotalHours:45**

## **REFERENCES**

1. Cornelius Scheffer and Paresh Girdhar Practical "Machinery Vibration Analysis and Predictive Maintenance" Elsevier, 2004.
2. Collacatt R.A., "Mechanical fault Diagnosis and Condition Monitoring", Chapman and Hall Ltd, 2004.
3. A.R. Crawford, "The Simplified Handbook of Vibration Analysis," Volumes 1&2, Computational Systems, Inc., Knoxville, 1992
4. Gupta A.K., "Reliability, maintenance and safety engineering", University science press, New Delhi, 1st edition, 2009.
5. J.D. Campbell and J. V. Reyes- Picknell "Up time Strategies for Excellence in Maintenance Management," 2nd Edition Productivity Press, Portland, OR, 2006
6. H.P. Bloch and F.K. Geitner, "An Introduction to Machinery Reliability Assessment," Gulf Publishing, Houston, 1994.
7. R.B. Northrop, "Introduction to Instrumentation and Measurements," CRC Press, Boca Raton, 1997.
8. "Maintenance Technology," The magazine of plant equipment reliability, maintenance, and asset management, Barrington, IL.
9. A.R. Crawford, "The Simplified Handbook of Vibration Analysis," Volumes 1&2, Computational Systems, Inc., Knoxville, 1992.
10. E.A. Elsayed, "Reliability Engineering," Addison Wesley, Reading, MA, 1996.
11. T. Wireman, "Developing Performance Indicators for Managing Maintenance," Industrial Press, New York, 1998.
12. J. Moubray, "Reliability-Centered Maintenance," Industrial Press, New York, 1997.



**Course Objectives**

- To understand the basics of various types of sensors
- To study and compare the characteristics of different types of sensors
- To gain knowledge in selecting the suitable sensor for the engineering applications

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Describe the various types of strain gauges and their measurement techniques.
- Compare the characteristics of different types of sensors.
- Explain the working principles of various sensors used in physical parameter measurements.
- Apply the knowledge in selecting the suitable sensor for the engineering applications.

**Course Content****STRAIN AND PRESSURE MEASUREMENT 9 Hours**

Resistance strain gauge, piezoelectric pressure gauge, characteristics. Electronic circuits for strain gauge, load cells. Interferometer, Fibre-optic methods. Pressure gauges Aneroid capacitance pressure gauge, ionization gauge, Using the transducers for applications.

**MOTION SENSORS****9 Hours**

Capacitor plate sensor, Inductive sensors, LVDT Accelerometer systems, rotation sensors drag cup devices, piezoelectric devices. Rotary encoders.

**LIGHT RADIATION****9 Hours**

Color temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber-optic applications, light transducer, solid-state transducers liquid crystal devices.

**HEAT AND TEMPERATURE****9 Hours**

Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, thermistors, PTC thermistors, bolometer, Pyroelectric detector.

**ELECTRONIC SENSORS****9 Hours**

Proximity detectors – Inductive and capacitive, ultrasonic, photo beam detectors Reed switch, magnet and Hall-effect units, Doppler detectors, liquid level detectors, flow sensors, smoke sensors

**Total Hours :45**

**REFERENCES:**

1. Doebelin, E O, "Measurement Systems, Application and Design" , McGraw Hill, 5<sup>th</sup> Edition, 2004
2. Jack P Holman, "Experimental Methods for Engineers", McGraw Hill, USA, 7<sup>th</sup> Edition 2001.
3. Ian R Sinclair, "Sensors and Transducers", Third Edition, Newnes publishers, 2001.
4. Robert G Seippel, "Transducers, Sensors and Detectors", Reston Publishing Company, USA, 1983.

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**U13MCE 210      CONCEPTS OF ENGINEERING  
DESIGN**

**L T P C  
3 0 0 3**

**Course Objectives**

- To understand the basics of engineering design and its principles
- To study about stress- strain concepts and data acquisition methods.
- To incorporate environmental aspects in the engineering design

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Design a model by applying various engineering principles.
- Apply stress and strain principles to the systems in a logical and discerning manner.
- Use modeling, simulation and computing tools and techniques for new product development.
- Recognize environmental constraints and safety issues in engineering.

**Course Content**

**INTRODUCTION**

**12 Hours**

Design Engineer- Aspirations, Competency, Engagement, Iceberg model of competency, Functional competency, Behavioral Competency, Traits & Motives of a Design Engineer, Personality Assessment. Visualization and freehand sketching - Understanding of form and functions, freehand sketching of a typical modern kitchen, plan of a house, an executive's modern office, domestic products like chair, water bottle Engineering Design - Engineering design process, Identification and analysis of needs, Organization of design concept, Modeling, Design Management, Information Gathering, Presentation Techniques. Review of Mechanics -Force, torque, power, moment of inertia, bending moment, eccentric loading, friction.

**DESIGN PRINCIPLES**

**8 Hours**

Occam's Razor, Saint-Venant's Principle, Golden Rectangle, Abbe's Principle, Maxwell's Reciprocity Theorem, Self-Principles, Stability, Symmetry, Parallel Axis theorem, Accuracy, Repeatability, Resolution, Sensitivity direction, Fool Proofing, Form design principles, DFX-Typical application examples.

**STRESS AND STRAIN**

**9 Hours**

Loading (elastic and plastic, buckling), stress, strain, Young's modulus, shear modulus, stress-strain curve (yield strength, ultimate tensile strength, proof strength, percentage elongation), tensile stress and shear stress computation, thermal stress, stress concentration factor, hoop stress, bending of beams, torsion of shafts, ductility, toughness, Hertzian contact stress, Fatigue (high-cycle, low-cycle), fracture mechanics (Initiation, Propagation, failure), springs-strain energy, bearings-an overview.

**INNOVATION AND INVENTION SERIES**

**9 Hours**

Creativity-development concepts, examples, Concept Evaluation, Mind Maps, TRIZ, Intellectual Property Rights. Planned experimentation through Labview Graphical Programming -Introduction, the front panel, the block diagram, data acquisition, components of a DAQ system, DAQ hardware configuration, DAQ assistant, analog I/O, digital I/O, typical sensor interface examples.



## **GREEN DESIGN PROCESS**

**7 Hours**

Environment impact assessment, factors in material selection for green design, material properties, energy content, eco-indicators, calculation of the eco-indicator, manufacturing issues, environmental issues, Evaluation of alternative materials example. Introduction to lean concepts - Lean Concepts in Manufacturing, Lean design principles

**Total Hours : 45**

## **PROJECT BASED LAB SESSIONS:**

1. Assembly and Dismantling of a Bicycle
2. Sensor Interface to monitor temperature by employing thermocouple using LabVIEW graphical programming
3. Study of automotive systems cut sections of automotive components.
4. Cut sectional view of six cylinder diesel engine showing cam operated valves, piston, connecting rod, cam shaft, timing gear, diaphragm clutch, synchromesh gear box, brake assembly, wheel assembly and differential gear box.

## **REFERENCES:**

- 1 Michael Ashby, Hugh Shercliff and David Cebon, "Materials Engineering, Science, Processing and Design", Elsevier, 2008,
- 2 James Garrat, "Design and Technology", Cambridge University Press, 2004.
- 3 Allen Strickland Hall, Alfred R. Holowenko, Herman G. Laughlin, "Schaum's Outline of Machine Design", Tata McGraw-Hill Education Private Limited, New Delhi, 2008.
- 4 LabVIEW: User Manual By National Instruments, 2000.
- 5 Mike Ashby and Kara Johnson, "Materials and Design – The Art and Science of Material Selection in Product Design", Elsevier, Second Edition.
- 6 Faculty of Mechanical Engineering, "PSG Design Data Book", PSG College of Technology.
- 7 Myer Kutz, "Environmentally Conscious Mechanically Design", John Wiley & sons, 2007.
- 8 Jacob, Golden Berg, David Mazursky, "Creativity in Product Innovation", Cambridge University Press, 2002
- 9 Kalevi Rantanen, Ellen Domd, "Simplified TRIZ, New Problem Solving Application for Engineers and Manufacturing Professional", CRC Press, 2002
- 10 Ronald G. Askin, Jeffrey B. Goldberg, "Design and Analysis of Lean Production Systems", Wiley India, 2007.
- 11 James P. Womack, Daniel T. Jones, "Lean Thinking: Banish Waste And Create Wealth In Your Corporation", Simon & Schuster, 2003.



**Course Objectives**

- To study about learning Rapid Prototyping is to enhance the knowledge of students in the field of prototyping,
- The syllabus will also provide knowledge on the various RP Machines and their process capabilities.

**Course Outcomes**

**After successful completion of this course, the students should be able to,**

- Explain the principles and processes of rapid prototyping (RP), rapid tooling (RT), and reverse engineering (RE) technologies.
- Identify the limitations of RP, RT, and RE technologies for product development;
- Summarize the importance of RP, RT, and RE technologies in product development with case some studies

**Course Content****OVERVIEW OF RAPID PROTOTYPING****9Hours**

Definitions, evolution, CAD for RPT, Product design and rapid product development, conceptual design, detail design, prototyping, Fundamentals of RP systems, 3D solid modeling software and their role in RPT, creation of STL file

**LIQUID BASED RP PROCESSES****9Hours**

Liquid based RP systems: Stereo lithography (SLA)-principle-process parameters-process details-machine details- applications Solid Ground Curing - Principle- process parameters process details-machine details, Applications.

**SOLID BASED RP PROCESSES****9 Hours**

Fusion Deposition Modeling - Principle- process parameters-process details-machine details, Applications. Laminated Object Manufacturing - Principle- process parameters-process details-machine details, Applications.

**POWDER BASED RP PROCESSES****9Hours**

Powder based RP systems: Selective Laser Sintering (SLS)- Principle- process parameters process details-machine details- Applications. 3-Dimensional Printers - Principle- process parameters-process details-machine details, Applications, and other Concept Modelers like Thermo jet printers, Sander's model maker.

**RAPID TOOLING****10Hours**

Principles and typical process for quick batch production of plastic and metal parts through quick tooling. Reverse Engineering – 3D scanning-3D digitizing and Data fitting- Vacuum Casting.

**CASE STUDIES:** RP in Aerospace Industry, Automotive Industry, Jewelry Industry, Arts and Architecture.

**Total Hours :45****REFERENCES:**

1. Pham D.T & Dimov.S.S, "Rapid manufacturing", Springer-Verlag, London, 2011
2. Chua C.K. et al., "Rapid Prototyping: principles and applications" Wiley, 2003
3. Jacobs P.F., "Stereolithography and other Rapid Prototyping & Manufacturing





4. Technologies”, McGraw Hill, New york, 1996
5. Hilton P.D., “Rapid Tooling” Marcel Dekkar, 2000
6. Zeid I., “CAD/CAM: Theory & Practice”, McGraw Hill, Singapore, 1991.

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**Course Objectives**

- To know about different primary energy sources and renewable energy sources
- To study the solar energy measurement and designing of various solar energy utilized systems
- To study the principles of different non-conventional energy sources and their utilization.
- To understand the applications of energy from waste and designing of biogas plant
- To get an exposure in various direct energy conversion systems

**COURSE OUTCOMES:**

**After successful completion of this course, the students should be able to**

1. Relate the effect of renewable and non renewable energy sources on climate change and other global contemporary issues.
2. Describe solar energy generation, measurement systems and calculate the performances of various solar energy systems.
3. Summarize other renewable energy resources and their usage in power generation.
4. Compute performance characteristics of direct energy conversion systems and explain their storage and transport phenomena.

**Course Content****ENERGY AND ENVIRONMENT****9 Hours**

Primary energy sources – world energy resources – energy cycle of the earth – environmental aspects of energy utilization, Emissions and Global warming – Renewable energy resources and their importance – Potential impacts of harnessing the different renewable energy resources.

**SOLAR ENERGY****9 Hours**

Principles of solar energy collection – solar radiation – measurements – instruments – data and estimation – types of collectors – characteristics and design principles of different type of collectors, performance and testing of collectors – Solar water and air heaters – performance and applications – solar cooling – solar drying – solar ponds – solar tower concept – solar furnace.

**WIND, TIDAL AND GEOTHERMAL ENERGY****9 Hours**

General theory of windmills – types of windmills – design aspects of horizontal axis windmills – applications – Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants – Geothermal power plants.

**BIOENERGY****9 Hours**

Energy from bio mass and bio gas plant – types and design of biogas plants – applications – Energy from wastes – utilization of industrial, municipal and agricultural wastes.



## **DIRECTENERGY CONVERSIONSYSTEM**

**9 Hours**

Magneto hydrodynamic systems (MHD) - thermoelectric generators – thermionic generators – fuel cells – solar cells – types, EMF generated, power output, losses and efficiency applications. Hydrogen conversion and storage systems.

**CASE STUDIES: Effects of Nuclear power plant, Thermal power plants, Wind and tidal power plants**

**Total Hours : 45**

### **REFERENCES:**

1. Rai G.D, “Non conventional Energy sources” Khanna Publishers, New Delhi. 4th edition (24th Reprint), 2009
2. “Renewable Energy Sources and Emerging Technologies”, Kothari, Eastern Economy Edition, 2009.
3. Sukhatme, S.P., “Solar Energy, Principles of Thermal Collection and Storage”, 3rd Edition, Tata McGraw Hill, 2008.
4. B.H.Khan, “Non Conventional Energy Resources”, Tata McGraw Hill”, 2nd Edition 2009.
5. S.Rao and Parulekar, “Energy Technology – Non conventional, Renewable and Conventional”, Khanna Publishers, 3rd Edition (6th Reprint), 2009.
6. Garg. H. P and Prakash. J., “Solar Energy - Fundamentals and applications”, , Tata McGraw Hill, 1st revised edition 2000



### Course Objectives

- To study how to measure biochemical and various physiological information.
- To study the need and technique of electrical safety in Hospitals.
- To study the use of radiation for diagnostic and therapy.
- To study about recorders and advanced equipments in medicine

### Course Outcomes:

**After successful completion of this course, the students should be able to,**

- Explain different measurement techniques used in physiological parameters measurement.
- Describe the sensors and signal conditioning circuits used in biomedical engineering.
- Comment on various measurement systems used in diagnostics.
- Differentiate the working of recorders and explain the advanced systems used in medicine.

### Course Content

#### INTRODUCTION

**9Hours**

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential, source of bioelectric potentials – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

#### BIO-MEDICAL SENSORS AND TRANSDUCERS

**9Hours**

Basic transducer principles Types — resistive, inductive, capacitive, fiber-optic, photoelectric, chemical, active and passive transducers and their description and feature applicable for biomedical instrumentation – Bio, Nano sensors and application.

#### SIGNAL CONDITIONING AND DISPLAY

**9 Hours**

Input isolation, DC amplifier, instrumentation, charge amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply, basis of signal conversion and digital filtering, data reduction technique – time and frequency domain technique.

#### MEDICAL MEASUREMENT AND MONITORING SYSTEMS 9Hours

Blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter, cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – cardiac pacemaker –defibrillator patient safety - electrical shock hazards - Centralized patient monitoring system.



## **RECORDERS AND ADVANCED SYSTEMS**

**9 Hours**

Oscillographic – galvanometric - thermal array recorder, photographic recorder, storage oscilloscopes, electron microscope. Biotelemetry, Diathermy, Audiometers, Dialysers, Lithotripsy.

**CASE STUDIES: Hot wire Anemometry for respiratory flow measurements.**

**Total Hours :45**

### **REFERENCES:**

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TMH, 2009.
2. Cromwell, Weibell and Pfeiffer, “Biomedical Instrumentation and Measurements”, Prentice Hall of India, 2<sup>nd</sup> Edition, 2007.
3. Geddes L.A., and Baker, L.E., “Principles of Applied Bio-medical Instrumentation”, , John Wiley and Sons, 3<sup>rd</sup> Edition, 1995.
4. Tompkins W.J., “Biomedical Digital Signal Processing”, Prentice Hall of India, 1998.
5. M.Arumugam, „Bio-Medical Instrumentation“, Anuradha Agencies, 2003.



## **U13MCE 304 INTELLECTUAL PROPERTY RIGHTS (IPR)**

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<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **Course Objectives**

- To study the legal concepts in Science, Engineering, Technology and Creative Design.
- To study new scenario, Intellectual Property Rights should occupy the central stage in the economic development.
- To study revision of national legislation on Intellectual Property Rights (IPR) as well as to the establishment or modernization of Government structures that administer such legislation

### **Course Outcomes:**

**After successful completion of this course, the students should be able to,**

1. Distinguish various property rights.
2. Describe the procedures to obtain Intellectual Property Rights.
3. Explain the effective usage of copyrights and international practices with some case studies

### **Course Content**

#### **INTRODUCTION**

**9 Hours**

Introduction - Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property (Movable Property, Immovable Property and Intellectual Property).

#### **PATENTS, COPYRIGHTS AND TRADEMARKS**

**9 Hours**

IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration - Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures.

#### **INTERNATIONAL CONVENTION RELATING TO INTELLECTUAL PROPERTY**

**9 Hours**

Introduction - Establishment of WIPO - Mission and Activities - History - General Agreement on Trade and Tariff (GATT).

#### **IPR STRATEGIES**

**9 Hours**

Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

#### **CASE STUDIES**

**9 Hours**

Case Studies on - Patents (Basmati rice, turmeric, Neem, etc.) - Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

**Total Hours : 45**



## REFERENCES

1. Subbaram N.R., S. Viswanathan *"Handbook of Indian Patent Law and Practice"*, Printers and Publishers Pvt. Ltd., 1998.
2. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1994.
3. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
4. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
5. [www.ipmatters.net/features/000707\_gibbs.html.]

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**Course Objectives**

- To acquire knowledge about different searching techniques and algorithms.
- To train the system in playing games.
- To Study the concept of representing knowledge and facts using reasoning and structures.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Explain the characteristics of AI systems with different searching techniques and algorithms.
- Develop algorithms to train the system in playing games.
- Summarize the concepts of knowledge representation.
- Design a simple AI System.

**Course Content****INTRODUCTION****10 Hours**

Definition – Pattern recognition – Criteria of success – Production Systems – Control Strategies – Heuristic Search – Problem Characteristics – Production System Characteristics – Forward and backward reasoning – Matching Indexing – Heuristic Functions, Search algorithms.

**GAME PLAYING****8 Hours**

Overview – Minimax search procedure – Adding Alpha – Beta cutoffs – Waiting for Quiescence – Secondary search – Using book moves.

**KNOWLEDGE REPRESENTATION USING CONVENTIONAL LOGICS****10 Hours**

Use of Predicate logic – Introduction to representation – representing simple facts in logic augmenting the representation – resolution – Conversion to clause form – The basis of resolution Unification of algorithm – Question answering – Natural Deduction.

**KNOWLEDGE REPRESENTATION USING MODERN LOGICS 8Hours**

Nonmonotonic reasoning – Statistical Probabilistic reasoning – Techniques for dealing with a random world and deterministic world – rule based system.

**STRUCTURAL REPRESENTATIONS OF KNOWLEDGE****9 Hours**

Common knowledge structures – level of representation – Right structures – Declarative representations – Semantic nets – Conceptual dependency Frames Scripts – Procedural representation – Natural language understanding – Perception – learning – Implementation A.I. Systems.

**Total Hours :45**



## REFERENCES:

1. Elaine Rich, "Artificial Intelligence", McGraw-Hill Book Co., 2009.
2. M. W. Richaugh, "Artificial Intelligence, A. Knowledge Based Approach", PWS Rent Publishing Boston, 1998.
3. Charniac. E and M.C.Dermott. "Introduction to Artificial Intelligence", Addison Wesley Publishing Company, 2002.
4. Robert Goodell Brown, "Materials Management Systems – A Members Library", John Wiley Publishers, 1977.
5. Westing Fine and Zone, "Purchasing Management Principles", John Wiley Publishers, 1986

A handwritten signature in black ink, appearing to be 'A. V. Singh' or similar, located at the bottom center of the page.

**Course Objectives**

- To acquire knowledge about fundamental concepts of industrial automation.
- To study the detail about designs in assembly and pneumatics control.
- To understand and able to write programming for Robot and CNC automation.
- To Study the concept of representing knowledge and facts used to design various applications.

**Course Outcomes**

**After successful completion of this course, the students should be able to**

- Apply industrial automation concepts for a given problem.
- Choose transfer lines and automated assembly for a given system.
- Use and program various systems used in automation.
- Differentiate Mechatronics design process from conventional design.

**Course Content****FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION 7 Hours**

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation. Introduction to HMI systems – text display, touch panels and integrated displays.

**TRANSFER LINES AND AUTOMATED ASSEMBLY****9 Hours**

General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines. AS/RS, RFID system, AGVs, modular fixturing. Flow line balancing.

**PNEUMATIC CONTROL & SYSTEM DESIGN****12Hours**

Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow, air motors, air hydraulic equipments. Pneumatic control system design: General approach to control system design, symbols and drawings, schematic layout, travel step diagram, circuit, control modes, program control, sequence control, cascade method, Karnaugh- Veitch mapping.

**PROGRAMMABLE AUTOMATION & ROBOTIC SYSTEMS 11Hours**

Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems. Robotic systems: Basic structure of a robot–robot end effectors. Classification of robots–accuracy, resolution and repeatability of a robot. Drives and control systems–mechanical components of robots–sensors and vision systems. Transducers and sensors-tactile sensors, proximity sensors and range sensors, vision systems. Robot motion control and robot programming.



## DESIGN OF MECHATRONIC SYSTEMS

**6Hours**

Stages in design, traditional and mechatronic design, possible design solutions. Case studies-pick and place robot, engine management system.

**Total Hours :45**

### REFERENCES:

1. Mikell P Groover, "Automation Production Systems and Computer- Integrated Manufacturing" Pearson Education, New Delhi, 2008.
2. Wemer Depper ,Kemprath Reihe , Vogel Buch and Kurt Stoll, "Pneumatic Application", Verlag Wurzburg, 1987.
3. Bolton W, "Mechatronics", Pearson Education, Second Edition, 1999.
4. Steve F Krar, "Computer Numerical Control Simplified", Industrial Press, 2001.
5. Mikell P Groover, "Industrial Robots – Technology Programmes and Applications" , McGraw Hill , New York, USA. 2000.
6. Wemer Deppert and Kurt Stoll, "Pneumatic Application", Kemprath Reihe, Vovel Verlag , Wurzburg, 1976.
7. Festo K G, "Pneumatic Tips", Festo, Germany, 1987.
8. Nitaigour Premchand Mahadik, "Mechatronics", Tata Mc Graw-Hill, Publishing Company, Ltd., 2003.
9. Rolf Isermann, "Mechatronic Systems Fundamentals", Springer, 2003.
10. John W Webb and Ronald A Reis, "Programmable Logic Controllers", Prentice Hall, Inc., 1999.
11. Robert H Bishop, "Mechatronics: Introduction", Taylor and Franics, 2006.
12. Peter Smid, "CNC Programming Techniques: An Insider's Guide to Effective Methods and Applications", Industrial Press, 2006.
13. Wisama Khalil and Etienne Dombre, "Robot Mainpulators Modeling, Performance Analysis and Control", ISTE, 2007.
14. Mark W Spong and Seth Hutchinson, "Robot Modeling and Control", Wiley-India Pvt. Ltd.,2006.



**Course Objectives**

- To acquire knowledge on nanostructures and its effect.
- To study the basics of nanomaterials and its characterization.
- To Study the concept of nanodevices and its applications.

**COURSE OUTCOMES:**

**After successful completion of this course, the students should be able to,**

- Classify nano structures and the effect on physical parameters of nano sizing.
- Describe nano systems, nano semiconductor fabrication process and the materials used in nano systems.
- Demonstrate nano system characterization techniques.
- Illustrate nano devices and thier applications.

**Course Content****INTRODUCTIONANDCLASSIFICATION****10Hours**

Classification of nanostructures, nanoscale architecture – Effects of the nanometre length scale – Changes to the system total energy, changes to the system structures, vacancies in nanocrystals, dislocations in nanocrystals – Effect of nanoscale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biologicalsystems.

**NANOMATERIALS AND CHARACTERIZATION****10Hours**

Fabrication methods – Top down processes – Milling, lithographics, machining process – Bottom-up process – Vapour phase deposition methods, plasma-assisted deposition process, MBE and MOVPE, liquid phase methods, colloidal and solgel methods – Methods for templating the growth of nanomaterials – Ordering of nanosystems, self-assembly and self-organisation – Preparation, safety and storage issues

**GENERIC METHODOLOGIES FOR NANOTECHNOLOGY****10Hours**

Characterisation: General classification of characterisation methods – Analytical and imaging techniques – Microscopy techniques - Electron microscopy, scanning electron microscopy, transmission electron microscopy, STM, field ion microscopy, scanning tunnelling microscopy, atomic force microscopy – Diffraction techniques – Spectroscopy techniques – Raman spectroscopy – Surface analysis and depth profiling – Mechanical properties, electron transport properties, magnetic and thermal properties.

**INORGANIC SEMICONDUCTOR NANOSTRUCTURES****8Hours**

Quantum confinement in semiconductor nanostructures - Quantum wells, quantum wires, quantum dots, superlattices, band offsets and electronic density of states – Fabrication techniques – Requirements, epitaxial growth, lithography and etching, cleared edge overgrowth – Growth on vicinal substrates, strain-induced dots and wires, electrostatically induced dots and wires, quantum well width fluctuations, thermally annealed quantum wells and self-assembly techniques.



## **NANODEVICES AND THEIR VARIOUS APPLICATIONS      7Hours**

Nanomagnetic materials – Particulate nanomagnets and geometrical nanomagnets – Magneto resistance – Probing nanomagnetic materials – Nanomagnetism in technology – Carbon nanotubes – fabrication- applications – Organic FET, organic LED"s – Organic photovoltaics – Injection lasers, quantum cascade lasers, optical memories, electronic applications, coulomb blockade devices.

**Total Hours : 45**

### **REFERENCES:**

1. Kelsall Robert W Ian Hamley, Mark Geoghegan, "Nanoscale Science and Technology", Wiley Eastern, 2005.
2. Michael Kohler, Wolfgang, Fritzsche, "Nanotechnology: Introduction to Nanostructuring Techniques", 2004.
3. William Goddard, Donald W Brenner, "Handbook of Nano Science Engineering and Technology", CRC Press, 2004.
4. Bharat Bhushan, "Springer Handbook of Nanotechnology", 2004.
5. Charles P Poole, Frank J Owens, "Introduction to Nanotechnology", John Wiley and Sons, 2003.
6. Mark Ratner, Danial Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea", Pearson, 2003.
7. Gregory Timp, "Nanotechnology", Springer-Verlag, 1999.



**U13MCE308**

## **INTRODUCTION TO AIRCRAFT ENGINEERING**

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### **Course Objectives**

- To acquire knowledge and overview about Aircraft industry.
- To study the basics of Aircrafts and its various principles in flights.
- To acquire knowledge about flight mechanics and its performance.
- To Study the concept of aircraft system in all disciplines such as electrical, electronics, mechanical and also environmental aspects.

### **COURSE OUTCOMES**

**After successful completion of this course, the students should be able to**

- Explain the evolution of aircrafts systems, trends of aerospace industry and the materials used in aerospace applications.
- Demonstrate the components and subsystems used in aircrafts.
- Analyse various parameters affecting the flight.
- Compare and contrast various mechanisms used for flying.
- Outline various mechanical and electronic systems used for controlling and navigation of aircrafts

### **Course Content**

#### **AIRCRAFT INDUSTRY OVERVIEW**

**5 Hours**

Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario

#### **INTRODUCTION TO AIRCRAFTS**

**6 Hours**

Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations.

#### **BASIC PRINCIPLES OF FLIGHT**

**10 Hours**

Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift. Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag. Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects



## **MECHANICS OF FLIGHT**

**8 Hours**

Aircraft Performance- Taking-off, Climbing, cruise, Landing, Power Curves, Manoeuvres- Pull out dives, The load Factor, Loads during a Turn, Correct and Incorrect Angles of Bank, Control and steep Banks, Inverted Maneuvers, Maneuverability", Stability and Control-Meaning of Stability and Control, Degree of Stability- Lateral, Longitudinal and Directional Stability, Dihedral and Anhedral Angles, Control of an Aeroplane", Aircraft Performance and Maneuvers- Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on a Aeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability

## **INTRODUCTION TO AIRCRAFT SYSTEMS**

**16 Hours**

Types of Aircraft Systems. Mechanical Systems. Electrical and Electronic Systems. Auxiliary systems. Mechanical Systems: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit, Electrical systems: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System

**Total Hours :45**

## **REFERENCES :**

1. A.C Kermode, "Flight without Formulae", Pearson Education, 10<sup>th</sup> Edition, 2001.
2. A.C Kermode, "Mechanics of Flight", Pearson Education, 5<sup>th</sup> Edition, 2007.
3. Shevell, "Fundamentals Of Flight", , Pearson Education, 2<sup>nd</sup> Edition.
4. Dave Anderson, "Introduction to Flight".
5. Ian moir, Allan Seabridge, "Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration".



**Course Objectives**

- To study about vehicle dynamics and how to control it under different loads, speed and road conditions in order to improve the comfort for the passengers and life of the various components of the vehicle.

**COURSE OUTCOMES:**

**After successful completion of this course, the students should be able to,**

- Demonstrate simple mechanical systems subjected to dynamic loads.
- Solve vehicle stability related problems.
- Design suspensions and characterise the forces acting on tyre, steering and braking.
- Summarise various methods of achieving vehicle stability and its control.
- Design and analyse simple suspension using simulations methods.

**Course Content****INTRODUCTION****9Hours**

Single degree of freedom, two degree of freedom, free, forced and damped vibrations modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber, Closed and coupled far system, orthogonality of mode shapes, modal analysis.

**STABILITY OF VEHICLES****9Hours**

Load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives. Lateral Vehicle Dynamics - Kinematic Models, Dynamic Bicycle Model, From Body Fixed to Global Coordinates. Longitudinal vehicle dynamics - Longitudinal Vehicle Model, Driveline Dynamics, Mean Value Engine Models.

**SUSPENSION AND TYRE DYNAMICS****9Hours**

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of sideforces, tyre dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

**LATERAL & LONGITUDINAL VEHICLE CONTROL****9Hours**

Steady State Analysis: Understanding Steady State Cornering, Control System Architecture, Individual Vehicle Stability and String Stability, Controller for Transitional Maneuvers, Automated Highway Systems, Longitudinal Control for Vehicle Platoons, String Stability with Inter-Vehicle Communication, Adaptive Controller for Unknown Vehicle Parameters, Rollover Prevention Control.





## **CASE STUDIES**

**9 Hours**

Introduction to simulation packages for vehicle dynamics. Active Suspension design for passenger cars, CVs and two wheelers. Design and analysis of suspension using simulation and analysis packages.

**Total Hours : 45**

## **REFERENCES:**

1. Rajesh Rajamani, "Vehicle Dynamics and Control", Springer Publications Ltd. 2<sup>nd</sup> Edition 2012.
2. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.
3. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
4. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi -2, 2002.
5. Heldt.P.M - "Automotive Chassis"- Chilton Co., New York- 1992
6. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
7. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998
8. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.



### **Course Objectives**

- To impart knowledge on various types of non destructive evaluation methods
- To understand the principles and working of different NDE methods
- To have knowledge on selection of such different methods for testing and evaluation of various components

### **Course Outcomes**

**After successful completion of this course, the students should be able to,**

- Describe and select an appropriate non destructive evaluation methods from the basic four methods.
- Summarize the sources, process and safety precautions of X-Ray radiography.
- Describe the wave propagation in media.
- Differentiate various scan methods, probes and noises present in the ultrasonic testing systems.

### **Course Content**

#### **ULTRA SONIC HARDNESS TESTING**

**9 Hours**

Flaw Detection Using Dye Penetrants. Magnetic Particle Inspection introduction to electrical impedance, Principles of Eddy Current testing, Flaw detection using eddy currents.

#### **INTRODUCTION TO X-RAY RADIOGRAPHY**

**9 Hours**

The Radiographic process, X-Ray and Gamma-ray sources, Geometric Principles, Factors Governing Exposure, Radiographic screens, Scattered radiation, Arithmetic of exposure, Radiographic image quality and detail visibility, Industrial XRay films.

#### **X-RAY RADIOGRAPHY PROCESSES**

**9 Hours**

Fundamentals of processing techniques, Process control, The processing Room, Special Processing techniques, Paper Radiography, Sensitometric characteristics of x-ray films, Film graininess signal to noise ratio in radiographs, The photographic latent image, Radiation Protection.

#### **INTRODUCTION TO ULTRASONIC TESTING**

**9 Hours**

Generation of ultrasonic waves, horizontal and shear waves, near field and far field acoustic wave description, ultrasonic probes- straight beam, direct contact type, angle beam, transmission/reflection type, and delay line transducers, acoustic coupling and media.

#### **ULTRASONIC TESTS**

**9 Hours**

Transmission and pulse echo methods, A-scan, B-scan, C-scan, F-scan and Pscan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, Zonal method using focused beam. Flow location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echos and noise. Ultrasonic flaw evaluation.



**CASE STUDIES:** NDT in flaw analysis of Pressure vessels, piping, Castings and Welded constructions. Train rail flaw analysis using ultrasonic tester with water couplant.

**Total Hours : 45**

**REFERENCES:**

1. Krautkramer and Krautkramer, “Ultrasonic testing” Springer-Verlag GmbH, 1990
2. Baldev Raj, T. Jayakumar and M. Thavsimuthu, “Practical Non-Destructive Testing” Woodhead Publishing, 2<sup>nd</sup> edition, 2002.
3. E. A. Gengel , “Ultrasonic inspection 2: Training for NDT”, Prometheus books 1995.



## U13MCE311      ENGINEERING METROLOGY

**L T P C**  
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### Course Objectives

- To understand the principle of Dimensional metrology
- To learn about Metrology instruments and application for various measurements
- To introduce concept of computer applications in Metrology
- To apply the principles, techniques and devices used for quality control in modern Industrial environment

### Course Outcomes

**After successful completion of this course, the students should be able to**

- Summarize various linear and angular measuring devices used to check dimensions.
- Describe the methods and instruments used in gear & screw parameters measurements.
- Explain the automated systems used in Metrology.
- Choose latest measuring tools for the modern Industrial environment.

### Course Content

**LINEAR METROLOGY      9Hours** Definition of metrology – Linear measuring instrument : Vernier, micrometer measurement, dial indicator, Slip gauges and classification, interferometer, optical flats - limit gauges, Comparators - Mechanical, pneumatic, optical and electric types, applications

**ANGULAR METROLOGY      9Hours**  
Sine bar, Vernier bevel protractor, optical bevel protractor, auto collimator, angle gauges, Clinometer, angle Decker – taper measurements.

**SCREW THREAD AND GEAR METROLOGY      9 Hours**

Screw thread terminology –Measurement of various elements of Thread-Measurement of Major and minor diameter-Measurement of Thread angle by Two Ball Method-Pitch Measurement. Types of Gear-Gear Terminology-Spur gear measurement -Run out ,Pitch ,Concentricity ,profile ,lead ,alignment ,Back lash- Chordal thickness Method-Constant chord method-Parkinson gear tester

**SURFACE MEASUREMENT      9 Hours**

Surface evaluation, Stylus method, Numerical values for surface assessment, Surface texture specimens, straightness, flatness and roundness measurement.

**ADVANCED TECHNIQUES IN METROLOGY      9Hours**

Coordinate measuring machine – constructional features – types and application, digital devices – computer aided inspection — machine vision systems, Profile projector, Universal Measuring Machine, Laser principles – Laser interferometer – application in linear, angular measurement and machine tool metrology.

**Total Hours : 45**



## REFERENCES

1. Jain. R K “Engineering Metrology” Khanna Publishers, 2009.
2. Manohar Mahajan, “A textbook of Metrology”, Dhanpat Rai & Co (P) LTD.,2008.
3. Alan S. Morris “The Essence of Measurement” Prentice Hall of India, 1997.
4. Connie Dotson, Ronger Harlow and Richard L Thomson, “Fundamentals of Dimensional Metrology”, Thompson – Delmar, 4<sup>th</sup> edition, 2006.
5. Gupta S C “Engineering Metrology “Dhanpat Rai Publications.



<b>U13GS7003</b>	<b>TOTAL QUALITY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **Course Objectives**

- Acquire knowledge on TQM concepts
- Acquire knowledge on quality systems
- Develop skills to use TQM tools for domain specific applications

### **Course Outcomes**

**After successful completion of this course, the students should be able to**

- Distinguish various total Quality Management concepts, principles and the various tools used to implement TQM.
- use statistical methods used in industries for quality control.
- recognize the importance of ISO and Quality system certification process .

### **Course Content**

#### **INTRODUCTION**

**9Hours**

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**

**9Hours**

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**

**9Hours**

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**

**9Hours**

Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

#### **QUALITY SYSTEMS**

**9Hours**

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 Hours : 45**



## REFERENCES

1. Dale H.Besterfiled, "Total Quality Management", Pearson Education JamesR.Evans& William M.Lidsay, "The Management and Control of Quality", South-Western (Thomson Learning), 2008.
2. Feigenbaum.A.V. "Total Quality Management", McGraw Hill
3. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 2007.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers.



## **INDUSTRIAL TRAINING**

At the end of 4<sup>th</sup> or 6<sup>th</sup> semester, all the UG students to undergo 1 week industrial training. They will work in an industry under the guidance of a professional. The students shall keep a log book and submit a report on their work describing the assignment, acquired knowledge, activities performed, contribution to industry and other relevant matters. It is highly recommended to undergo atleast one industrial training during the programme.

### **FIRST ASSESSMENT**

#### **ASSESSMENT RUBRICS FOR THE COMPANY**

S.NO	ACTIVITY	RATING				
		Satisfactory	Competent	Extra ordinary	Outstanding	Satisfactory
1.	Assignment					
2.	Attitude and Motivation					
3.	Contribution to industry					
4.	Progress of the assignment					





# **Department of Mechatronics Engineering**

## **VISION**

We, Mechatronics Engineering Department of Kumaraguru College of Technology strive to achieve academic excellence in Robotics and automation research, postgraduate teaching and innovative product development.

## **MISSION**

The Department is committed to set standards of excellence in its academic programmes by enabling its students to achieve a blending of knowledge acquisition and application of such knowledge in real life situations. It is also aimed to equip them to adapt themselves to changing global and local needs upholding professional ethics and contribute their might in transforming India into a world leader in technological advancement and prosperity.

