KUMARAGURU COLLEGE OF TECHNOLOGY

COIMBATORE – 641 049

REGULATIONS 2018A

CURRICULUM AND SYLLABUS

I-VIII Semesters

Department of Civil Engineering

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Vision

Department of Civil Engineering is striving to become as a world class Academic Centre for quality education and research in diverse areas of Civil Engineering, with a strong social commitment

Mission

- ❖ Producing highly competent and technologically capable professionals and motivated young Academicians
- ❖ Providing quality education in undergraduate and post graduate levels, with strong emphasis on professional ethics and social commitment.
- ❖ Developing a scholastic environment for the state – of –art research, resulting in practical applications.
- ❖ Undertaking professional consultancy services in diverse areas of Civil Engineering.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

PSO1:

The graduates will be able to plan, analyse, design and prepare technical reports for Civil Engineering structures as per BIS.

PSO2:

The graduates will be able to apply technical and management skills for the execution

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KUMARAGURU COLLEGE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING
Regulation 2018A (2023 Batch) - B.E CE - Curriculum

Semester I										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18ENI0201	Fundamentals of Communication - I	Theory	HS	2	0	2	0	3	Nil
2	U18TLR1001	Heritage of Tamil	Theory	HS	1	0	0	0	1	Nil
3	U18CSI1202	Problem Solving and Programming using C	Embedded - Theory & Lab	ES	3	0	2	0	4	Nil
4	U18MEI1201	Engineering Graphics	Embedded - Theory & Lab	ES	2	0	2	0	3	Nil
5	U18MAI1202	Linear Algebra and Calculus	Theory	ES	2	0	2	0	3	Nil
6	U18CHI1202	Engineering Chemistry	Theory	ES	2	0	2	0	3	Nil
7	U18INI1600	Engineering Clinics- I	Practical & Project	ES	0	0	4	2	3	Nil
								Total Credits	20	
								Total Contact Hours/week	29	

Semester II										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18ENI2201	Fundamentals of Communication - II	Embedded - Theory & Lab	HS	2	0	2	0	3	U18ENI 1201
2	U18CSI2201	Python Programming	Embedded - Theory & Lab	ES	2	0	2	0	3	Nil
3	U18PHI2201	Engineering Physics	Embedded - Theory & Lab	BS	3	0	2	0	4	Nil
4	U18MAI2201	Advanced Calculus and Laplace Transforms	Embedded - Theory & Lab	BS	3	0	2	0	4	U18MAI 1201
5	U18MET2003	Engineering Mechanics	Theory	ES	3	0	0	0	3	Nil
6	U18INI2600	Engineering Clinics -II	Practical & Project	ES	0	0	4	2	3	Nil
								Total Credits	20	
								Total Contact Hours/week	27	

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Semester III										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18MAT3101	Partial Differential Equations and Transforms	Theory	BS	3	1	0	0	4	Nil
2	U18CEI3201	Solid Mechanics	Embedded - Theory & Lab	ES	2	1	2	0	4	Nil
3	U18CEI3202	Engineering Survey	Embedded - Theory & Lab	PC	3	0	2	0	4	Nil
4	U18CEI3203	Building Materials and Construction	Embedded - Theory & Lab	PC	3	0	2	0	4	Nil
5	U18CET3104	Fluid Mechanics	Theory	ES	3	0	0	0	3	Nil
6	U18CER3505	Building Planning and Drawing	Lab	BS	0	0	2	0	1	Nil
7	U18INI3600	Engineering Clinics III	Practical & Project	ES	0	0	4	2	3	Nil
								Total Credits	23	
								Total Contact Hours/week	30	

Semester IV										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18MAT4101	Numerical Methods and Probability	Theory	BS	3	1	0	0	4	Nil
2	U18CEI4201	Applied Hydraulics and Hydraulic Machinery	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CET 3104
3	U18CEI4202	Highway and Traffic Engineering	Embedded - Theory & Lab	PC	3	0	2	0	4	Nil
4	U18CEI4203	Remote Sensing and Geographic Information Systems	Embedded - Theory & Lab	PC	2	0	2	0	3	Nil
5	U18CET4004	Strength of Materials	Theory	PC	3	0	0	0	3	U18CEI3 201
6	U18INI4600	Engineering Clinics -IV	Practical & Project	ES	0	0	4	2	3	Nil
								Total Credits	21	
								Total Contact Hours/week	27	

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Semester V										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1.	U18MBT5000	Total Quality Management	Theory	HS	3	0	0	0	3	Nil
2	U18CEI5201	Environmental Engineering	Embedded - Theory & Lab	PC	3	0	2	0	4	Nil
3	U18CEI5202	Soil Mechanics	Embedded - Theory & Lab	PC	3	0	2	0	4	Nil
4	U18CET5103	Structural Analysis	Theory	PC	3	1	0	0	4	U18CET 4004
5	U18_____	Open Elective I	Theory	OE	3	0	0	0	3	Nil
6	U18CET5005	Concrete Technology	Theory	PE	3	0	0	0	3	Nil
7	U18CEP5604	Survey Camp*	Project	PC	0	0	0	0	1	U18CEI3 202
								Total Credits	22	
								Total Contact Hours/week	23	

*10 days survey camp during the previous summer vacation

Semester VI										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18CEI6201	Design of Masonry and Reinforced Concrete Elements	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CEI3 201
2	U18CEI6202	Construction Project Management	Embedded - Theory & Lab	PC	3	0	2	0	4	Nil
3	U18CET6003	Foundation Engineering	Theory	PC	3	0	0	0	3	U18CEI5 103
4	U18CET6004	Design of Steel Structures	Theory	PC	3	0	0	0	3	U18CEI3 201
5	U18CEE____	Professional Elective-I	Theory	PE	3	0	0	0	3	Nil
6	U18_____	Open Elective II	Theory	OE	3	0	0	0	3	Nil
7	U18CEP6705	Inplant Training*	Project	PC	0	0	0	0	1	Nil
								Total Credits	21	
								Total Contact Hours/week	22	

*2 weeks in-plant training during the previous winter vacation.

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Semester VII										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18CET7001	Estimation Costing & Valuation	Theory	PC	3	0	0	0	3	Nil
2	U18CET7002	Irrigation and Water Resource Management	Theory	PC	3	0	0	0	3	Nil
3	U18CEE____	Professional Elective-II	Theory	PE	3	0	0	0	3	Nil
4	U18CEE____	Professional Elective-III	Theory	PE	3	0	0	0	3	Nil
5	U18CEE____	Professional Elective-IV	Theory	HS	3	0	0	0	3	Nil
6	U18CEP7703	Project Phase-I	Project	PW	0	0	0	6	3	Nil
								Total Credits	18	
								Total Contact Hours/week	21	

Semester VIII									
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C
1	U18CEP8701	Project Phase-II	Project	PW	0	0	0	24	12
								Total Credits	12
								Total Contact Hours/week	24

Total Credits	157

List of Mandatory courses

S.No	Couse Code	Course Title	Course Mode	CT	Sem
1	U18VEP1501	Human Excellence-Personal Values	Lab	HS	1
2	U17VEP2502	Human Excellence-Interpersonal Values	Lab	HS	2
3	U18VEP3503	Human Excellence-Family Values	Lab	HS	3
4	U18VEP4504	Human Excellence-Professional Values	Lab	HS	4

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5	U18CHT4000	Environmental Science & Engineering	Theory	MC	4
6	U18VEP5505	Human Excellence-Social Values	Lab	HS	5
7	U18INT6000	Constitution of India	Theory	MC	6
8	U18VEP6506	Human Excellence-National Values	Lab	HS	6
9	U18VEP7507	Human Excellence-Global Values	Lab	HS	7

Professional Electives									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
Structural Engineering									
1	U18CEE0001	Traditional Architecture	Theory	PE	3	0	0	0	3
2	U18CEE0002	Prefabricated Structures	Theory	PE	3	0	0	0	3
3	U18CEE0003	Design of Reinforced Concretestructures	Theory	PE	3	0	0	0	3
4	U18CEE0010	Prestressed Concrete structures	Theory	PE	3	0	0	0	3
5	U18CEE0011	Pre-Engineered Buildings	Theory	PE	3	0	0	0	3
6	U18CEE0012	Earthquake Engineering	Theory	PE	3	0	0	0	3
Environmental & Water Resources Engineering									
1	U18CEE0004	Environmental Impact Assessment and Life Cycle Analysis	Theory	PE	3	0	0	0	3
2	U18CEE0005	Surface water Hydrology	Theory	PE	3	0	0	0	3
3	U18CEE0006	Air and Noise Pollution Control	Theory	PE	3	0	0	0	3
4	U18CEE0013	Industrial Wastewate Treatment	Theory	PE	3	0	0	0	3
5	U18CEE0014	Climate change and Sustainable Management	Theory	PE	3	0	0	0	3
6	U18CEE0015	Waste Management	Theory	PE	3	0	0	0	3
7	U18CEE0019	Sustainable Infrastructure Development	Theory	PE	3	0	0	0	3
8	U18CEE0020	Occupational Health safety and well being	Theory	PE	3	0	0	0	3
Construction Management & Transportation Engineering									
1	U18CEE0007	Housing Planning and Management	Theory	PE	3	0	0	0	3
2	U18CEE0008	Intelligent Transportation Systems	Theory	PE	3	0	0	0	3
3	U18CEE0009	Sustainable Construction Methods	Theory	PE	3	0	0	0	3

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4	U18CEE0016	Building Information Management	Theory	PE	3	0	0	0	3
5	U18CEE0017	Mass Transit Management	Theory	PE	3	0	0	0	3
6	U18CEE0018	Railways Airport Dock and Harbour Engineering	Theory	PE	3	0	0	0	3
7	U18CEE0021	Ground Improvement Techniques	Theory	PE	3	0	0	0	3

Open Electives (OFFERED TO STUDENTS OF OTHER DEPARTMENTS)									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1	U18CEO001	Climate Change Impact on Water Resources	Theory	OE	3	0	0	0	3
2	U18CEO002	Fundamentals of Soil and Water Conservation Engineering	Theory	OE	3	0	0	0	3
3	U18CEO003	Green Building Concept and Design	Theory	OE	3	0	0	0	3
4	U18CEO004	Landscape Designing	Theory	OE	3	0	0	0	3
5	U18CEO005	Sustainable Technologies and Circular Economy	Theory	OE	3	0	0	0	3
6	U18CEO006	Green Building Design- Civil Engineering Focussed Tools and Techniques	Theory	OE	3	0	0	0	3

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SEMESTER I

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U18ENI0201 – FUNDAMENTALS OF COMMUNICATION-I

(Common to all Branches of I Semester B.E/B/Tech Programmes)

L	T	P	J	C
2	0	2	0	3

Course Objectives:

1. To communicate effectively by using appropriate grammar and technical parlance in a range of academic scenarios.
2. To interpret and critically evaluate discourses related to functional English.
3. To disseminate professional information through appropriate means of communication.

Course Outcomes:

After the course the student will be able to:

CO1: Communicate in English with correct grammar

CO2: Communicate effectively (Oral and Written)

CO3: Use communication skills in the real world

Assessment Methods:

Direct
1. Continuous Assessment of Skills
2. Assignment
3. Written Test
4. End Semester Examination

CO/PO Mapping:

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	**Programme Outcomes(POs)**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1										**S**		**S**		
CO2		**M**		**W**		**W**			**M**	**S**		**S**		
CO3		**M**		**M**		**W**			**M**	**S**		**S**		

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No	Topic	Hours
MODULE I - 12 Hrs		
1.1	Parts of Speech	2
1.2	Subject Verb Agreement	2
1.3	Speak up (Self Introduction, JAM)	4
1.4	Writing sentences using 'Be-forms'	3
1.5	Test	1
MODULE II - 12Hrs		
2.1	Articles, Gerunds, Infinitives	2
2.2	Speak up (Greetings & Polite English)	4
2.3	Dialogue Writing	3
2.4	Skimming & Scanning	2
2.5	Listening Skills - I	1
MODULE III - 12 Hrs		
3.1	Tenses & Voice	2
3.2	Sentences & its kinds	2
3.3	Speak up (Narration & Description)	4
3.4	Summarizing & Note-making	3
3.5	Listening Skills - II	1
MODULE IV - 12 Hrs		
4.1	Framing Questions – 4 types	2
4.2	Speak up (Role play)	4
4.3	Letter writing – Formal and Informal & Email Writing	3
4.4	Reading Comprehension & Cloze test	2
4.5	Listening Skills - III	1
MODULE V - 12 Hrs		
5.1	Degrees of Comparison	2
5.2	Clauses	2
5.3	Speak up (Power Point Presentation)	4
5.4	Writing (Picture perception)	3
5.5	Test	1
Total		**60**

Reference:

1. A Modern Approach to Non Verbal Reasoning (English, Paperback, Dr. R S Aggarwal)
2. The Power of Words(Bloomsbury, UK, 2012, Hyacinth Pink)
3. Word Power Made Easy: The Complete Handbook for Building a Superior Vocabulary (By Norman Lewis)
4. Effective Technical Communication Tata Mc Graw Hills Publications (Ashraf Rizvi)

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5. English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel)
6. Know Your Grammar: Trans.in Tamil & Malayalam –A Bilingual Approach (Bloomsbury, UK, 2012, Hyacinth Pink)

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U18CSI1202 PROBLEM SOLVING AND PROGRAMMING USING C

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Acquire knowledge on different problem solving techniques.
CO2: Use appropriate data types and control structures for solving a given problem.
CO3: Execute different array and string operations.
CO4: Experiment with the usage of pointers and functions
CO5: Organize data using structures and unions.

Pre-requisites: Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M							L			
CO2	S	M							L	L		
CO3	S	L			L	L			L	L		L
CO4	M	L	M	L	L	L			L	L		M
CO5	M	L	M	L	L	L			L	L		M

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory Component)
2. Assignment (Theory Component)
3. Group Presentation (Theory Component)
4. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component)
5. Model examination (lab component)
6. End Semester Examination (Theory and lab component)

THEORY COMPONENT CONTENTS

STRUCTURED PROGRAMMING **6 Hours**

Algorithms, building blocks of algorithms (instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem

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solving, simple strategies for developing algorithms (iteration). Introduction to C Programming – Operators and Expressions – Data Input and Output – Control Statements.

ARRAYS AND STRINGS **6 Hours**

Defining an array – Processing an array –Multidimensional Arrays Character Arithmetic – Defining a string – Initialization of Strings – Reading and Writing Strings – Processing Strings –Searching and Sorting of Strings

FUNCTIONS, STORAGE CLASSES **6 Hours**

Defining a function – Accessing a function – Function prototypes – Passing arguments to a function – Passing arrays to functions – Function with string - Recursion – Storage classes

POINTERS **7 Hours**

Pointer Fundamentals – Pointer Declaration – Passing Pointers to a Function – Pointers and one dimensional arrays – operations on pointers– Dynamic memory allocation.

STRUCTURES AND UNIONS **5 Hours**

Structures and Unions: Defining a Structure – Processing a Structure – User defined data types (Typedef) – Unions

Theory: 30	Tutorial: 0	Practical: 0	Project: 0	Total: 30 Hours

REFERENCES

1. Byron S Gottfried and Jitendar Kumar Chhabra, "Programming with C", Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. Pradip Dey and Manas Ghosh, "Programming in C", Second Edition, Oxford University Press, 2011.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
4. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
5. Reema Thareja, "Programming in C", Second Edition, Oxford University Press, 2011.

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LAB COMPONENT CONTENTS

LIST OF EXPERIMENTS **30 Hours**

1. Writing algorithms, flowcharts and pseudo codes for simple problems.
2. Programs on expressions and conversions
3. Programs using if, if-else, switch and nested if statements
4. Programs using while, do-while, for loops
5. Programs on one dimensional arrays, passing arrays to functions and array operations
6. Programs using two dimensional arrays, passing 2D arrays to functions
7. Programs using String functions
8. Programs using function calls, recursion, call by value
9. Programs on pointer operators, call by reference, pointers with arrays
10. Programs using structures and unions.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

REFERENCES

1. Byron S Gottfried and Jitendar Kumar Chhabra, "Programming with C", Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. Pradip Dey and Manas Ghosh, "Programming in C", Second Edition, Oxford University Press, 2011.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
4. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.

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U18MEI1201 **ENGINEERING GRAPHICS** **(Common to AE, AUE, CE, MCE, ME, EIE and EEE)**

L	T	P	PJ	C
2	0	2	0	3

Course outcome

At the end of the course, the student will be able to:

CO1: Construct various plane curves.

CO2: Construct projection of points and projection of lines.

CO3: Develop projection of surfaces and solids.

CO4: Solve problems in sections of solids and development of surfaces.

CO5: Apply free hand sketching and concepts of isometric in engineering practice.

CO6: Draw engineering drawing in AutoCAD with dimensions.

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										
CO2	S	S									W	
CO3	S	S									M	
CO4	S	S										
CO5	S	S										
C06	S											

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test, Assignment, Group Presentation
3. Viva, Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)

PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANES **9Hours**

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

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

Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane.

PROJECTION AND SECTION OF SOLIDS **9Hours**

Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

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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 SURFACES, ISOMETRIC PROJECTIONS AND FREE-HAND SKETCHING **9Hours**

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.
Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.
Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning.

INTRODUCTION TO AUTOCAD **9Hours**

Introduction to Drafting Software (AutoCAD) & its Basic Commands. Introduction to coordinate systems, object selection methods, selection of units and precession. sketching – line, circle, arc, polygon, rectangle and ellipse. Working with object snaps, layers and object properties. Editing the objects – copy, move, trim, extend, working with arrays, mirror, scale, hatch, fillet and chamfer.

ISOMETRIC VIEWS WITH AUTOCAD **9Hours**

Building drawings – Single and double bed room house (sectional Top view only). Introduction to Motion path animation. Isometric views of simple solid blocks.

Theory: 30	**Tutorial: 0**	**Practical:15**	**Project: 0**	**Total : 45 Hours**

REFERENCES

1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.
2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.
3. Nataraajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
4. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
5. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.
6. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

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U18MAI1202	LINEAR ALGEBRA AND CALCULUS (Common to All branches)	L	T	P	J	C
		3	0	2	0	4

COURSE OUTCOMES

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

CO1: Identify eigenvalues and eigenvectors and apply Cayley Hamilton theorem.

CO2: Apply orthogonal diagonalisation to convert quadratic form to canonical form.

CO3: Solve first order ordinary differential equations and apply them to certain physical situations.

CO4: Solve higher order ordinary differential equations.

CO5: Evaluate the total derivative of a function, expand the given function as series and locate the maximum and minimum for multivariate function.

CO6: Determine Rank, Inverse, Eigenvalues, Eigenvectors of the given matrix, Maxima-Minima of the function and Solving Differential equations using MATLAB

Pre-requisite: Basics of Matrices, Differentiation and Integration

CO/PO Mapping

S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S			M				M	M		M
CO2	S	S			M				M	M		M
CO3	S	S			M				M	M		M
CO4	S	S			M				M	M		M
CO5	S	S			M				M	M		M
CO6	S	S			M				M	M		M

Course Assessment methods:

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6. End Semester Examination (Theory and lab components)

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THEORY COMPONENT

MATRICES **6 Hours**

Rank of a matrix – Consistency of a system of linear equations - Rouche's theorem - Solution of a system of linear equations - Linearly dependent and independent vectors– Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem (excluding proof)

DIAGONALISATION OF A REAL SYMMETRIC MATRIX **6 Hours**

Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS **11 Hours**

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

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS **11 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 – Applications.

FUNCTIONS OF SEVERAL VARIABLES **11 Hours**

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

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.
4. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007
5. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008

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6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai,2003
7. Weir, MD, Hass J, Giordano FR: Thomas' Calculus, Pearson education 12th Edition, 2015
8. P.Bali., Dr. Manish Goyal., Transforms and partial Differential equations, University Science Press, New Delhi, 2010
9. G.B.Thomas and R.L.Finney, Calculus and analytical geometry, 11th Edition, PearsonEducation, (2006)

LAB COMPONENT **30 Hours**

List of MATLAB Programmes:

1. Introduction to MATLAB.
2. Matrix Operations - Addition, Multiplication, Transpose, Inverse
3. Rank of a matrix and solution of a system of linear equations
4. Characteristic equation of a Matrix and Cayley-Hamilton Theorem.
5. Eigenvalues and Eigenvectors of Higher Order Matrices
6. Curve tracing
7. Solving first order ordinary differential equations.
8. Solving second order ordinary differential equations.
9. Determining Maxima and Minima of a function of one variable.
10. Determining Maxima and Minima of a function of two variables.

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

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U18CHI1202	ENGINEERING CHEMISTRY (Common to All Branches)	L 3	T 0	P 2	J 0	C 4

Course Outcomes

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

CO1: Apply the basic principles of chemistry at the atomic and molecular level.

CO2: Analyze the impact of engineering solutions from the point of view of chemical principles

CO3: Apply the chemical properties to categorize the engineering materials and their uses

CO4: Integrate the chemical principles in the projects undertaken in field of engineering and technology

CO5: Develop analytical proficiency through lab skill sets to demonstrate in professional practice.

Pre-requisites :Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2	S		M		M							
CO3	S	M										
CO4	S			M					S		W	
CO5	S					M			S	W		

Course Assessment methods

Direct

1. Continuous assessment test I & II
2. Open book test; Cooperative learning re Group
3. Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable)
4. End Semester Examination

Theory Component

CHEMICAL BONDING **7 Hours**

Bonding: Introduction – Ionic bonding - Van der Waal's forces (dipole - dipole, dipole - induced dipole, induced dipole - induced dipole interactions) - hydrophobic interaction. Bonding in organic molecules: covalent and co-ordinate bonds (overview only) - hybridization (sp, sp2, sp3) - hydrogen bonding and its consequences.

THERMODYNAMICS **7 Hours**

Introduction - Thermodynamic process – Internal energy – Enthalpy – limitations of First law of thermodynamics – Second law of thermodynamics - Entropy - Third law of thermodynamics – Free Energy and Work Function – Clausius-Clapeyron equation - Maxwell's relations – Kirchhoff's equation.

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ELECTROCHEMISTRY AND CORROSION **7 Hours**

Electrodes - Electrode Potential – Nernst equation and problems - Galvanic cell - Electrochemical Series.

Corrosion: Classification and mechanism of chemical and electrochemical corrosion - Factors influencing corrosion

Corrosion control: Inhibitors – Cathodic protection (Sacrificial anodic protection, Impressed current cathodic protection) – Protective coating: Electroplating (Au) and Electroless plating (Ni).

WATER TECHNOLOGY **6 Hours**

Introduction - soft/hard water - Disadvantages of hard water in industries– scale, sludge, priming and foaming, caustic embrittlement.

Treatment of hard water: External treatment (Ion exchange method) - Internal treatment (colloidal, carbonate, phosphate and calgon conditioning) - Desalination (Reverse osmosis, Electrodialysis)

ENGINEERING MATERIALS **9 Hours**

Polymer: Introduction – Preparation, Properties and Applications of PMMA, PET, PVC.

Composites: Constituents of Composites – Polymer Composites - Metal Matrix Composites - Ceramic Matrix Composites – Applications

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

SURFACE CHEMISTRY AND CATALYSIS **9 Hours**

Adsorption: Types of adsorption – Adsorption isotherms: Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – Applications of adsorption on pollution abatement.

Catalysis: Catalyst – catalytic poisoning and catalytic promoters - autocatalysis –- acid base catalysis – enzyme catalysis – Michaelis-Menten equation – applications.

Chemical kinetics: Introduction – first order, pseudo first order, second order, zero order equations – parallel reactions – opposing reactions.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2017.
2. Puri B.R., Sharma L.R., Pathania, M.S. Principles of physical chemistry, Vishal Publishing Co., 2017
3. Atkins, P. and de Paula, J., Atkin's Physical Chemistry, 9th ed., Oxford Univ.

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4. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
5. Samir Sarkar., Fuels and Combustion, 3rd Edition, Orient Longman, India, 2009.
6. Dara S.S. and Umare S.S., A text book of Engineering Chemistry, S.Chand and Company Limited, New Delhi, 2014.
7. Engineering Chemistry, Wiley India Editorial Team, Wiley, 2018.

LABORATORY COMPONENT

LIST OF EXPERIMENTS

1. Preparation of Standard solutions
2. Conductometric estimation of mixture of acids vs strong base
3. Estimation of extent of corrosion of Iron pieces by Potentiometry
4. Estimation of the extent of dissolution of Copper / Ferrous ions by spectrophotometry.
5. Estimation of acids by pH metry.
6. Determination of total, temporary and permanent hardness by EDTA method.
7. Estimation of DO by Winkler's method
8. Estimation of Alkalinity by Indicator method.
9. Estimation of Chloride by Argentometric method
10. Estimation of Sodium and Potassium in water by Flame photometry.
11. Determination of Flash and Fire point of lubricating oil
12. Determination of Cloud and Pour point of lubricating oil
13. Determination of relative and kinematic viscosities of lubricating oil at different temperatures
14. Determination of corrosion rate on mild steel by Weight loss method
15. Morphological studies of corrosion on mild steel by microscopic techniques

Theory: 0 Tutorial: 0 Practical: 30 Project: 0 Total: 30 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,2012.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London,2003.

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SEMESTER II

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U18ENI2201 – FUNDAMENTALS OF COMMUNICATION - II

(Common to all branches of II Semester B.E/B/Tech Programmes)

L	T	P	J	C
2	0	2	0	3

Course Objectives:

1. To adopt relevant job related oral and written communication skills to competently perform in campus recruitments.
2. To train students in presentation skills, persuasive skills and career skills.
3. To comprehend critical text leading to academic articulation.

Course Outcomes:

After the course the student will be able to:

CO1: Demonstrate comprehension

CO2: Write reports and projects

CO3: Communicate verbally in the business environment

Assessment Methods:

Direct
1. Continuous Assessment of Skills
2. Assignment
3. Written Test
4. End Semester Examination

CO/PO Mapping:

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	PROGRAMME OUTCOMES (POs)												PSO	PSO
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		M		M						S		S		
CO2		W							W	S		S		
CO3			M			M			M	S		S		

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No	Topic	Hours
MODULE I - 12 Hrs		
1.1	Writing Instructions, Recommendations	2
1.2	Listening Skills - IV	1
1.3	Speak up (Debate)	5
1.4	Writing Memos, Circulars, Agenda and Minutes	3
1.5	Test	1
MODULE II - 12 Hrs		
2.1	Interview Skills I	4
2.2	Writing a Technical Report	3
2.3	Transcoding Graphics	3
2.4	Reading Short Stories – Home Assignment	1
2.5	Listening Skills -V	1
MODULE III - 12 Hrs		
3.1	Interview Skills II	5
3.2	Writing Reviews – Product Review/ Article Review	3
3.3	Book Review – Home Assignment	1
3.4	Reading Comprehension – Double Passage	2
3.5	Listening Skills - VI	1
MODULE IV - 12 Hrs		
4.1	Inferential Reading	2
4.2	Speak up (GD)	5
4.3	Creating an organizational flowchart	1
4.4	Drafting a project proposal	3
4.5	Listening Skills - VII	1
MODULE V - 12 Hrs		
5.1	Speak up (Formal Presentation)	4
5.2	Reading & Responding to texts	2
5.3	Writing a News story / Advertisement	2
5.4	Writing Essays	2
5.5	Test	2
Total		**60**

Reference:

1. Word Power Made Easy: The Complete Handbook for Building a Superior Vocabulary (By Norman Lewis)
2. Effective Technical Communication Tata McGraw Hills Publications (Ashraf Rizvi)
3. English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel)
4. Verbal Ability (Bloomsbury, UK, June 2012) Hyacinth Pink

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U18CSI2201 **PROBLEM SOLVING AND PROGRAMMING USING PYTHON**
(Common to All Branches)

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Develop simple Python program in interactive and script mode.

CO2: Solve problems using control statements in Python

CO3: Construct Python programs using functions and strings.

CO4: Make use of Python lists ,set, tuples, dictionaries to represent compound data.

CO5: Build Python Programs to read and write data from/to files.

CO6: Develop python programs to handle exceptions.

Pre-requisites :Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M		M				M	M		M
CO2	S	S	M		M				M	M		M
CO3	S	S	M		M				M	M		M
CO4	S	S	M		M				M	M		M
CO5	S	S	M		M				M	M		M
CO6	S	S	M		M				M	M		M

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test, Assignment, Group Presentation
3. Viva, Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)

THEORY COMPONENT CONTENTS

BASICS OF PYTHON PROGRAMMING **6 Hours**

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Introduction-Python interpreter- interactive and script mode; values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON 6 Hours

Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion.

DATA STRUCTURES: STRINGS,LSTS,SET 7 Hours

Strings: string slices, immutability, string methods and operations; Lists: creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions ; list
processing : list comprehension, searching and sorting, Sets: creating sets, set operations.

DATA STRUCTURES: TUPLES, DICTIONARIES 5 Hours

Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries.

FILES, MODULES, PACKAGES 6 Hours

Files and exception: text files, reading and writing files, format operator, exception handling, modules, packages.

Theory: 30	Tutorial: 0	Practical: 0	Project: 0	Total: 30 Hours

REFERENCES

1. Ashok NamdevKamthane,Amit Ashok Kamthane, Programming and Problem Solving with
   Python , Mc-Graw Hill Education,2018.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press ,
   2013.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
6. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem

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Solving Focus, Wiley India Edition, 2013.

E BOOKS AND ONLINE LEARNING MATERIALS

1. www.mhhe.com/kamthane/python
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Programs using expressions and input and output statements.
2. Programs using operators and built in functions.
3. Programs using conditional statements.
4. Program to exchange the values of two variables.
5. Program to test whether a given year is a leap year or not
6. Programs performing all string operations.
7. Programs using functions
8. Programs to find square root, GCD, exponentiation, sum an array of numbers
9. Programs to perform linear search, binary search
10. Programs to perform operations on list
11. Programs using dictionary and set
12. Programs to work with Tuples.
13. Programs to sort elements (Selection, Insertion, Merge, Quick)
14. Programs to search element.
15. Program to perform word count in file.
16. Program to copy file
17. Program to read and write file
18. Programs using modules and packages

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

ONLINE COURSES AND VIDEO LECTURES:
http://nptel.ac.in

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		L	T	P	J	C
U18PHI2201	**Engineering Physics**	**3**	**0**	**2**	**0**	**4**

Course Objectives:

- Having an ability to apply mathematics and science in engineering applications
- Having a clear understanding of the subject related concepts
- Having Sense-Making Skills of creating unique insights in what is being seen or observed

Expected Course Outcome:

Students will acquire the necessary knowledge about modern physics and its applications in various engineering andtechnology disciplines. This course meets the following student outcomes

- an ability to apply knowledge of physics in engineering problems
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to identify, formulate, and solve engineering problems

KINEMATICS & RIGID BODY MOTION **9 hours**

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

PROPERTIES OF MATTER AND MATERIALS TESTING **9 hours**

Properties of matter: Hooke's Law Stress - Strain Diagram - Elastic moduli - Relation between elastic constants - Poisson's Ratio - Expression for bending moment and depression - Cantilever - Expression for Young's modulus by Non uniform bending and its experimental determination.

Materials testing: Mechanism of plastic deformation, slip and twinning – types of fracture – Vickers Hardness test - fatigue and creep test.

HEAT **9 hours**

Specific heat capacity, thermal capacity. Temperature rise. Coefficient of linear thermal expansion. Methods of measurement of thermal expansion. Thermal stresses in composite structures due to non-homogeneous thermal expansion. Applications -The bimetallic strip. Expansion gaps and rollers in engineering structures. Thermal conductivity: differential equation of heat flow. Lee's disc

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apparatus for determination of thermal conductivity. Thermal Insulation. Convection and radiation. Applications to refrigeration and power electronic devices.

ELECTROSTATICS & MAGNETOSTATICS **10 hours**

ELECTROSTATICS : Maxwell's equation for electrostatics – E due to straight conductors, circular loop, infinite sheet of current - electric field intensity (D) - Electric potential - dielectrics - dielectric polarization - internal field – Clasious - Mosotti equation - dielectric strength - applications.

MAGNETOSTATICS: Maxwell's equation for magnetostatics - B in straight conductors, circular loop, infinite sheet of current - Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law –Magnetic flux density (B) – magnetic materials – Magnetization – Applications.

NEW ENGINEERING MATERIALS AND NANO TECHNOLOGY **8 hours**

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

Nano Materials: synthesis - Ball milling - Sol-gel - Electro deposition — properties of nano particles and applications. – Carbon Nano Tubes – fabrication by Chemical Vapour Deposition - structure, properties & applications.

Total Lecture hours: 45 hours

Text Book(s)

1. Elements of Properties of Matter, Mathur D.S., Shyamlal Charitable Trust, New Delhi, 1993.
2. Properties of matter, Brijlal and Subramaniam, S.Chand and Co, New Delhi, 2004.
3. Introduction to Mechanics, Verma M. K. (CRC Press), University Press, 2000.
4. Engineering Electromagnetics, W. H. Hayt and John A. Buck, 6th Edition, Tata McGraw Hill, New Delhi, 2014.
5. Nano – the Essentials, Pradeep T., McGraw-Hill Education, Pvt. Ltd., 2007.

Reference Books

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1. Modern Physics, Raymond A. Serway, Clement J. Mosses, Curt A. Moyer, 3rd Edition, Cengage learning, Boston, 2010
2. Laser Systems and Applications, Nityanand Choudhary and Richa Verma, PHI Learning Private Ltd., New Delhi, 2011
3. Principles of Electromagnetics, Matthew N.O. Sadiku, 4th Edition, Oxford, New Delhi, 2010
4. Introduction to Fiber Optics, Ajoy Ghatak and K. Thyagarajan, Cambridge University Press, New Delhi, 2010

Mode of Evaluation: Quizzes, Digital Assignments, CAT-I and II and FAT

Recommended by Board of Studies: 22.03.2018

LABORATORY COMPONENT

COURSE OUTCOMES

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

LIST OF EXPERIMENTS

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
6. Melde's string – To determine the frequency
7. Non-uniform bending and Uniform bending – determination of Young's modulus
8. Determination of solar cell parameters – Lux metre
9. Four probe experiment – to determine the band gap
10. Hysteresis curve – to determine the B-H values

Experiments beyond syllabus:

1. Semiconductor laser
2. Hall effect
3. Animations – (Laser, Fiber optics)

Theory: 0	**Tutorial: 0**	**Practical: 15**	**Project: 0**	**Total: 15 Hours**

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U18MAI2201 **ADVANCED CALCULUS AND LAPLACE TRANSFORMS**

L	T	P	J	C
3	0	2	0	4

(Common to All branches)

COURSE OUTCOMES

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

CO1: Evaluate double and triple integrals in Cartesian coordinates and apply them tocalculate area and volume.

CO2: Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.

CO3: Construct analytic functions of complex variables and transform functions from z-plane to w-plane and vice-versa, using conformal mappings.

CO4: Transform Functions in Time Domain to Frequency Domain using Laplace Transform

CO5: Transforms to Solve Ordinary Differential Equations and Integral Equations

CO6: Determine multiple integrals, vector differentiation, vector integrals and Laplace transforms using MATLAB

Pre-requisites :Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S			M				M	M		M
CO2	S	S			M				M	M		M
CO3	S	S			M				M	M		M
CO4	S	S			M				M	M		M
CO5	S	S			M				M	M		M

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) (Theory component)
3. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component)
4. Model examination (lab component)
5. End Semester Examination (Theory and lab component)

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THEORY COMPONENT

MULTIPLE INTEGRALS **10 Hours**

Double integration – Cartesian coordinates – Change of order of integration - Application: Area as double integral - Triple integration in Cartesian coordinates — Volume as triple integral.

VECTOR DIFFERENTIATION **6 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields.

VECTOR INTEGRATION **6 Hours**

Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and simple applications

ANALYTIC FUNCTIONS **8 Hours**

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

LAPLACE TRANSFORMS **8 Hours**

Definition of the Laplace Transform; Properties of the Laplace Transform – Superposition, Shift in t or Time Delay, Shift in s, Time Derivatives, Time Integral-Initial Value Theorem - Final Value Theorem; Transform of periodic functions

INVERSE LAPLACE TRANSFORMS **7 Hours**

Inverse transforms - Convolution theorem – Applications to solution of linear ordinary differential equations of second order with constant coefficients - Solution of integral equations.

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
4. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008.
5. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.

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6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai, 2003.
7. Weir, MD, Hass J, Giordano FR: Thomas' Calculus Pearson education 12th ED, 2015.
8. N.P.Bali., Dr. Manish Goyal., — Transforms and Partial Differential equations, University science Press, New Delhi, 2010

LAB COMPONENT **30 Hours**

List of MATLAB Programmes:

1. Evaluating double integral with constant and variable limits.
2. Area as double integral
3. Evaluating triple integral with constant and variable limits
4. Volume as triple integral
5. Evaluating gradient, divergence and curl
6. Evaluating line integrals and work done
7. Verifying Green's theorem in the plane
8. Evaluating Laplace transforms and inverse Laplace transforms of functions including impulse.
9. Heaviside functions and applying convolution.
10. Applying the technique of Laplace transform to solve differential equations.

Theory: 45 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 75 Hours**

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U18MET2003 **ENGINEERING MECHANICS**

L	T	P	J	C
3	0	2	0	4

CO 1: Apply the fundamental concepts in determining the effect of forces on a particle.

CO2: Make use of various principles in the determination of effect of forces in a rigid body.

CO 3: Determine the geometry dependant properties of solids and sections

CO 4: Solve problems in static friction,

CO 5: Identify motion and determine the velocity and acceleration of a particle.

CO 6: Apply the principles of kinetics in solving problems in dynamics.

Pre-requisites :Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S								M	M		
CO2	S								M	M		
CO3	S								M	M		
CO4	S								M	M		
CO5	S								M	M		
CO6	S								M	M		

Statics of particles **9 hours**

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

Statics of rigid bodies **9 hours**

Principle of transmissibility – Moment of force about a point – Varignon's theorem – Moment of a couple – Equivalent couple – Moment of force about an axis – Coplanar non-concurrent forces acting on rigid bodies – Resultant and equilibrium – Resolution of a given force into force couple system – Equilibrium in three dimensions – Reactions and supports.

Geometry dependant properties **9 hours**

Centre of gravity, Centre of mass and Centroid – Moment of Inertia of simple and complex areas – Transfer formula – Radius of gyration – Polar moment of inertia – Product of inertia - Mass moment of Inertia of simple solids.

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Friction **6 hours**

Laws of friction – coefficient of friction – Dry friction – wedge friction – ladder friction – rolling resistance.

Dynamics of particles **12 hours**

Kinematics – Rectilinear and curvilinear motion – projectile motion Kinetics – Newton's second law – D'Alembert's Principle – Work Energy method – Principle of Impulse momentum – Impact of Elastic Bodies

REFERENCES:

1. Beer F P and Johnson E R, "Vector Mechanics for Engineers, Statics and Dynamics", Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 2006.

2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.

3. J.L. Meriam & L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics (Volume II), 7th edition, Wiley student edition, 2013.

4. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.

5. Irving H. Shames, G. Krishna Mohana Rao, Engineering Mechanics - Statics and Dynamics, Fourth Edition – PHI / Pearson Education Asia Pvt. Ltd., 2006.

6. Rajasekaran S and Sankarasubramanian G, "Engineering Mechanics-Statics and Dynamics", Vikas Publishing House Pvt. Ltd., New Delhi, 2006

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SEMESTER III

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U18MAT3101	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS (Common to AE/AUE/CE/ME/MCE/EEE)	L	T	P	J	C
		3	1	0	0	4

Course Outcomes (COs):

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

CO1: Form partial differential equations and solve certain types of partial differential equations.

CO2: Determine the Fourier Series and half range Fourier Series of a function

CO3: Solve one dimensional wave equation, one dimensional heat equation in steady state using Fourier series.

CO4: Apply Fourier series to solve the steady state two dimensional heat equation in cartesian coordinates.

CO5: Identify Fourier transform, Fourier sine and cosine transform of certain functions and use Parseval's identity to evaluate integrals..

CO6: Evaluate Z – transform of sequences and inverse Z – transform of functions and solve difference equations.

Pre-requisite: NIL

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M			M				M	M		S
CO2	S	M		M								
CO3	S	S	S		S				M	M		S
CO4	S	M	M									M
CO5	S	M	M		S							
CO6	S	S			S				M	M		S

Course Assessment methods:

Direct
1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

PARTIAL DIFFERENTIAL EQUATIONS **9+3 Hours**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of

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standard types of first order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Linear homogeneous partial differential equations of second and higher order with constant coefficients.

FOURIER SERIES **9+3 Hours**

Dirichlet's conditions – General Fourier series – Odd and Even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS **5+2 Hours**

Classification of second order quasi linear partial differential equations –Solution of one dimensional wave equation – One dimensional heat equation (excluding insulated ends) – Fourier series solutions in Cartesian coordinates.

BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS **4+1 Hours**

Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

FOURIER TRANSFORM **9+3 Hours**

Statement of Fourier integral theorem – Infinite Fourier transforms – Sine and Cosine Transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

Z –TRANSFORM **9+3 Hours**

Z-transform - Elementary properties – Convolution theorem- Inverse Z – transform (by using partial fractions, residues and convolution theorem) – Solution of difference equations using Z - transform.

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

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition. 2014.
2. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand & Company ltd., New Delhi, 2006.
4. Ian Sneddon., "Elements of partial differential equations", McGraw – Hill, New Delhi, 2003.
5. Arunachalam T., "Engineering Mathematics III", Sri Vignesh Publications, Coimbatore 2013.

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		L	T	P	J	C
U18CEI3201	**SOLID MECHANICS**	**2**	**1**	**2**	**0**	**4**

Course Objectives

- The objective of this course is to know the basics of solid mechanics.
- To understand the concepts of mechanics of structures.
- To understand the behavior.
- Determine the internal forces and analyses the stresses of various structural elements under action of different types of forces.

Course Outcome

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

CO1: Apply the fundamental concepts of stress and strain in the analysis of various structural components and machines**.**

CO2: Analyze the beams to determine shear forces, bending moments**.**

CO3: Determine the bending, shear stresses and deflection produced in a beam

CO4: Analyze and design shafts and springs used in vehicles and structures

CO5: Find out the design forces in truss members.

Pre-requisites: Engineering Mechanics

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12
CO1	S	S			M					W		M
CO2	S	S		S	M					W		
CO3	S	S		S	M							S
CO4	S	S	S	M		S						M
CO5	S	S		S								M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Discussion.
3. End Semester Examination

SIMPLE STRESSES AND STRAINS **5+3Hours**

Stresses - Strain - Strain energy due to axial force, impact and suddenly applied load- Hooke's law- Relationship among elastic constants- Factor of safety-Thermal stresses- Compound bars- 2 D State of stresses- Mohr's circle.

SHEAR AND BENDING IN BEAMS **5+3Hours**

Beams and bending - Shear force and bending moment diagrams for statically determinate beams with different loading conditions.

FLEXURAL AND SHEAR STRESSES **5+2Hours**

Theory of simple bending- Analysis of determinate beams for stresses- Shear and Bending Stress distribution at a cross section with different loading conditions.

SLOPE AND DEFLECTION IN BEAMS **5+3Hours**

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Deflection of determinate beams - Double integration method-Macaulay's methods- Area moment method- Conjugate beam method for the computations of slopes and deflections.

SHAFTS AND SPRINGS **5+2Hours**

Elastic theory of Torsion –Solid and hollow circular shafts - Combined bending moment and torsion of shafts- strain energy due to torsion- Modulus of rupture- Power transmitted to shaft- Closed and open coiled helical springs- Leaf springs.

PLANE AND SPACE TRUSSES **5+2Hours**

Plane trusses- Analysis of trusses - Method of joints – Method of sections; Space truss – Tension Co-efficient Method

PRACTICALS **30 Hours**

1. Tension test on Mild steel/Cast-iron rods
2. Impact tests on metals
3. Indentation hardness test on metals.
4. Deflection of simply supported beam/Cantilever Beam (Virtual Study)
5. Torsion test on round mild steel/cast-iron rods
6. Tests on Helical Springs
7. Compression test on wood specimen and Bricks
8. Bending Stresses (Virtual Study)
9. Mohr's Circle (Virtual Study)
10. Model Making: Plane Truss (Pin jointed simply supported/Cantilever Truss)

Theory: 30	Tutorial: 15	Practical: 30	Project: 0	Total: 75 Hours

REFERENCES

1. Popov, E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, (2009).
2. Punmia.B.C, Ashok Kumar Jain, Arun Kumar Jain., Mechanics of Materials, Laxmi Publications (P) Ltd., 2017.
3. Timoshenko. S and Gere. J. M. Mechanics of Materials, A&C, Black 2 Ed.,2013.
4. Rajput. R. K., Strength of Materials: Mechanics of Solids., Edition 4, S. Chand Limited, New Delhi, 2015.
5. Ramamrutham. S, Narayan. R. Strength of Materials, Dhanpat Rai Publishing Company (P) Limited. 2017.
6. Kazmi, S. M. A., Solid Mechanics, TMH, Delhi, India., 2008.
7. Hibbeler. R. C., Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall.2012.

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U18CEI3202	ENGINEERING SURVEY	L	T	P	J	C
		3	0	2	0	4

Course Outcomes

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

CO1: Gain a solid understanding of the fundamental principles and concepts of surveying, including measurements and surveying instruments.

CO2: Conduct surveys to accurately measure and elevations of a given area using appropriate surveying techniques and equipment.

CO3: Evaluate the methods of setting out different types of curves and hydrographic surveying procedures to ensure proper application in real-world scenarios.

CO4: Examine modern field survey systems, including EDM and total station, to enhance accuracy and efficiency in surveying tasks.

CO5: Plan GPS surveying techniques and understand their integration with photogrammetry and remote sensing for comprehensive geospatial data acquisition.

Course Objectives

- Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
- Translate the knowledge gained for the implementation of Civil infrastructure facilities
- Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing

Pre-requisites : Nil

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M		S	S				M	M		M	S	M
CO2	S	M	S	S	S				M	M		M	S	M
CO3	S	M	S	S	S				M	M		M	S	M
CO4	S	M		S	S				M	M		M	S	M
CO5	S	M		S	S				M	M		M	S	M

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Discussion.
3. End Semester Examination

BASIC SURVEYING **9 Hours**

Principles, Linear measurements – Conversions - Chain – Tape – Ranging. Compass surveying – types – Error Corrections. Introduction to Levelling- Contours- Areas and volume calculation.

THEODOLITE AND TACHEOMETRY SURVEYING **9 hours**

Theodolite survey: Measurement of horizontal angle, vertical angle and distance; Horizontal and vertical control -triangulation - Signals. Baseline - Tacheometric surveying- types

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CURVES & HYDROGRAPHIC SURVEY **9 Hours**

Elements of simple curve, compound curve, Reverse curve, Transition curve and Vertical curves - Methods of setting out of simple curve - Introduction to hydrographic surveying- Tides-MSL- Sounding methods- Three-point problem.

MODERN FIELD SURVEY SYSTEMS **9 Hours**

Principle of Electronic Distance Measurement, Modulation, and Types of EDM instruments, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey. Care and maintenance of Total Station instruments.

GPS SURVEYING **9 Hours**

Basic concepts – Different segments- space, control and user segments-satellite configuration- signal structure- orbit determination and representation -Task of control segment- Hand held and Geodetic receivers-data processing-Traversing and triangulation. Fundamentals of Photogrammetry and Remote sensing.

Practical Work:

1. Setting out of Foundation by Ranging and Chaining.
2. Find the Reduced level of points using Fly levelling
3. Find the Reduced level of points using Check levelling
4. Measurement of horizontal angles by Reiteration and Repetition Method
5. Determination of gradient of line by Tacheometric surveying - Tangential system - Stadia system
6. Setting out of Simple curve (right/left-handed).
7. Determine the area of the given location using Total station
8. Determine the height and distance of the point by Single plane method and Double plane method using Total Station
9. Mark the column points in the field by using Total Station

Theory: 45	**Tutorial: 0**	**Practical:30**	**Project: 0**	**Total: 75Hours**

REFERENCES

1. Dr. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain, Surveying (Volume –I and II), Lakshmi Publications, 17th Edition, 2016
2. Duggal S K., Surveying, Vol-I and II, MCGraw Hill Education(India) Private Limited, 4th Edition, 2013.
3. Basak N N, Surveying& Levelling, Tata McGraw-Hill Education,2nd Edition, 2014
4. Madhu, N, Sathiskumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2nd Edition, 2017.
5. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
6. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2nd Edition, 2016
7. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 4th Edition, 2012.

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U18CEI3203	BUILDING MATERIALS AND CONSTRUCTION	L	T	P	J	C
		3	0	2	0	4

Course Objectives

- To gain knowledge about the various materials used for the construction work.
- To understand various types of foundation and masonry.
- To know the types of floors and roofs, plastering, damp proof courses and various support structures adopted in building construction.

Course Outcome

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

CO1 : Apply knowledge of stones, bricks, and aggregates to evaluate their suitability for construction applications.

CO2: Analyze the properties and manufacturing processes of cement, concrete, and other miscellaneous materials to select appropriate materials for specific uses.

CO3: Evaluate different foundation and masonry techniques to recommend the most suitable options for various structural requirements.

CO4: Analyze various flooring and roofing systems to identify solutions that prevent dampness and enhance structural durability.

CO5: Assess supporting structures, plastering, and pointing techniques to suggest improvements for effective construction practices.

CO6: Demonstrate practical testing methods on cement and concrete to determine their mechanical properties and workability.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M			S	S		S	M	S	M	S	W	
CO2	S	M			S	M	M	S	M	M	M	S		
CO3	M	M	M	M	M	M			M			M	M	
CO4	M		M		M	S	M	M		M				S
CO5	M		M		S	S					M	S		
CO6	M			M	S	M			S				S	S

Course Assessment methods:

Direct
1. Continuous Assessment Test I, II (Theory component) 2. Assignment, Group Presentation (Theory component) 3. End Semester Examination (Theory component)

BUILDING MATERIALS **12 Hours**

Stone Selection of stones, Dressing and tests on stones.

Bricks

Classification, Manufacturing of bricks. Field and laboratory tests on bricks- compressive strength, water absorption, efflorescence, dimension and warpage.

Timber

Types, uses and applications of timber, Defects in timber and wood, Seasoning, wood products with specific uses.

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Fine aggregate

Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate

Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

CEMENT, CONCRETE AND MISCELLANEOUS MATERIALS — 9 Hours

Cement Manufacturing process, Types on cement.

Concrete Ingredients, manufacturing, types of special concrete and mix design by IS method.

Miscellaneous materials

Plastics and PVC, paints and varnishes, concrete blocks, Materials for false ceiling, Glass, geotextiles and Ceramic products.

FOUNDATION AND MASONRY — 9 Hours

Safe bearing capacity of soil, Function and requirements of good foundation, types of foundation – Shallow and Deep foundations.

Terminologies in masonry. Brick masonry, characteristics and requirements of good brick masonry, Types of Bonds in brick work. Stone masonry, Requirements of good stone masonry, Classification.

FLOORS AND ROOFS — 10 Hours

Components of Floors, Flooring material - Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roof- Requirement of good roof, Types of roof, Trussed roof - King post Truss, Queen Post Truss, Different roofing materials.

Causes of dampness; Methods of preventing dampness; Damp proofing materials, DPC treatment in Buildings - Anti-termite treatment, site preparation, soil treatment and post construction treatment.

SUPPORTING STRUCTURES, PLASTERING AND POINTING — 5 Hours

Scaffolding- Types of scaffolding; Shoring -types of shoring; Underpinning and Methods of underpinning; Formwork - Types of formwork; Plastering – types of mortars for plastering, methods of plastering, Special materials used in plastering, Defects in plastering; Pointing.

PRACTICALS — 15 Hours

List of Experiments

Cement

1. Determine the fineness of cement
2. Determine the initial setting time of cement
3. Determine the compressive strength on cement mortar

Concrete

4. Determine the workability of concrete using slump test
5. Determine the workability of concrete using compaction factor test
6. Determine the workability of concrete using flow table test
7. Determine the compressive strength of concrete
8. Determine the tensile strength of concrete
9. Determine the flexural strength of concrete

Theory: 45	Tutorial: 0	Practical: 15	Project: 0	Total: 60 Hours

REFERENCES

1. B.C.Punmia, "Building Construction", Laxmi Publications, New Delhi. 2016.
2. G.S.Birdie, T.D.Ahuja, "Building Construction and construction materials", Dhanpatrai

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publishing company, New Delhi, 2012
3. SK Duggal, “Building Materials,” New Age Publications 4th Edition, April, 2014
4. Varghese. P.C. “Building Construction”, Prentice hall of India Pvt. Ltd. New Delhi, 2015.
5. Shah M.G. Kalec M. & Palki SY Building Drawing, Tata McGraw Hill, New Delhi, 2000.
M.S.Shetty. “Concrete Technology”, S Chand and Company Limited, New Delhi, 2017

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U18CET3104 FLUID MECHANICS

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To understand fluid pressure and buoyancy.
- To learn pipe network analysis.
- To introduce the model analysis in engineering problems.

Course Outcome

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

CO1: Measure the pressure within a fluid flow and fluid pressure on a plane and curved surface.

CO2: Analyse the stability of floating and submerged bodies in a fluid.

CO3: Apply the working concepts of various devices used to measure the velocity and discharge of fluid.

CO4: Analyse a pipe network.

CO5: Understand the kinematics that exists in the fluid flow and draw flow net.

CO6: Formulate the functional relationships that exist between dependent and independent variables of fluid flow.

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M	M	M	M	W		W		S		S	M
CO2	S	S	W	M	W	M	M				S		S	M
CO3	S	S	M	S	M	M			M		S		S	M
CO4	S	M	S	M	M	M	W				S		S	M
CO5	M	M	M	M	M	W			M		M		M	M
CO6	M	M	W	M	M	M	W				M	M	M	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Assignment, Group Presentation
3. End Semester Examination

PROPERTIES OF FLUID & FLUID STATICS 9 Hours

Units of measurement, Newtonian and Non-Newtonian fluids; Vapour pressure, compressibility and Elasticity; Surface Tension and Capillarity.

Variation of static pressure; Pascal's law; Atmospheric, Absolute and gauge pressure; Pressure measurement by mechanical gauges and manometers; pressure on plane surfaces and curved surfaces

BUOYANCY AND FLOATATION 4 Hours

Buoyancy; Buoyant force and Centre of Buoyancy; Stability of submerged bodies and floating bodies; Metacentre; Determination of Metacentric height – Experimental and Theoretical methods

DYNAMICS OF FLUID 8 Hours

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Euler's equation of motion; Bernoulli's equation; Application of Bernoulli's equation; Discharge and velocity measurements – Venturimeter, Orificemeter, nozzle, Pitot tube; Energy correction factor; momentum principle

FLOW THROUGH PIPES **8 Hours**

Laminar and turbulent flows through pipe; Hagen-Poiseuille equation; Darcy-Weishbach equation; Major and Minor losses; Pipes in series and in parallel; Pipe Network Analysis

KINEMATICS OF FLUID **7 Hours**

Methods of describing fluid motion; Classification of flow; Steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; Three, two and one-dimensional flows; irrotational and rotational flows; Streamline; Path line; Streak line; Equation for acceleration; Continuity equation; Velocity potential and stream function; flow net; Vortex flow-Free vortex and forced vertex flow.

DIMENSIONAL ANALYSIS **9 Hours**

Rayleigh's method; Buckingham's π theorem; Geometric, Kinematic, and Dynamic similitude; Scale effect; Distorted models

Theory: 45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

1. Fox and McDonald, "Introduction to Fluid Mechanics", Wiley, 8th Edition, 2011.
2. Modi & Seth, "Hydraulics and Fluid Mechanics", Standard Publishers.
3. R K Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 9th Edition, 2017.
4. C.S.P. Ojha, P.N. Chandramouli, and R. Berndtsson, "Fluid Mechanics and Machinery", Oxford University Press, 2010.

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U18INI3600	ENGINEERING CLINIC - III	L	T	P	J	C
		0	0	4	2	3

Course objectives

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

Course Outcomes

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

CO1: Identify a practical problems and find a solution

CO2: Understand the project management techniques

CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite:U18INI2600

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	PSO2
CO1	S	S	S	S	S	M	W		S			S		M
CO2											S			
CO3										S				M

Course Assessment methods:

1. Project reviews 50%
2. Workbook report 10%
3. Demonstration & Viva-voce 40%

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the third semester, students will focus primarily on Design project combining concepts learnt in Engineering clinics I and II.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of Prototype.

otal Hours: 90

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U18CER3505 Building Planning and Drawing

L	T	P	J	C
0	0	2	0	1

Course Objectives

At the end of this course the student should have learnt about the different tools and working procedure of Auto Cad software and basic idea about building plan, elevation and section.

Course Outcomes

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

CO1: Design building plans that adhere to the principles of planning and comply with relevant by-laws.

CO2: Develop detailed structural element drawings with precision.

CO3: Develop drafting skills in drawing plan, section and elevation of residential buildings using drafting software.

CO4: Develop drafting skills in drawing plan, section and elevation of public buildings using drafting software..

CO5: Formulate comprehensive plans and related drawings tailored to specific building requirements.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	M	M	M	M	W	M	M	M	M	S	M
CO2	S	S	M	M	M	W	M	W	M	M	M	W	S	M
CO3	S	S	S	M	S	W	W	W	M	S	M	M	S	M
CO4	S	S	S	M	S	W	W	W	M	S	M	M	S	M
CO5	S	S	S	M	S	M	M	W	M	M	M	M	S	M

Course Assessment methods

Direct
1. Pre-or Post-experiment Test/Viva; Experimental Report for each experiment; Comprehensive report / Model Examination
Indirect
1. Course-end survey

BUILDING PLANNING

Provisions of National Building Code-Building bye-laws-open area-setbacks-FAR terminology-Principles of planning-orientation-ventilation and lighting.

BUILDING ELEMENTS

Foundations-Plinthbeam-Column-Beam-Slab-Lintel-Staircase-Roof-doorsand windows -Types -Specifications-Standard sizes-Notations.

PLANNING OF RESIDENTIAL AND COMMERCIAL

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BUILDINGS

Singlebedroom-doublebed-room-multi-storeybuildings-Hospitalsbuildingswith PharmacyandDispensaries-SchoolBuildingwithHostel-Factorybuildingswithsteel truss

List of Experiments **30Hours**

Preparation of line sketches in accordance with functional requirements and building rules for the following types of building as per National Building Code:

1. Flat roof residential building
2. Pitched roof residential building

Detailed Drawings (Plan, Elevation and section for the following)

3. Flat roof building with load bearing wall
4. Pitched roof with load bearing wall
5. Framed structures
6. Industrial Building

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

REFERENCES

1. Shah, M.G, Kale, C.M, Patki, S.Y, "Building Drawing - With an Integrated Approach to Built Environment", Tata McGraw-Hill, 2007.
2. Randy Shih, "Autocad2016 Tutorial First Level -2D Fundamentals", Schroff Development Corp, 2015.
3. Mark W. Huth Delmar, "Understanding Construction Drawings", Cengage Publishers, 2013.
4. Donald Watson, "Time-Saver Standards for Building Materials & Systems: Design Criteria and Selection Data", Tata McGraw Hill Education, 2009.
5. National Building Code of India2016, Thirdedition, Bureau of Indian Standards, Govt. of India, 2016

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U18VEP3503	FAMILY VALUES	L	T	P	J	C
		0	0	2	0	1

Course Outcomes

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

CO 1: Develop skills in maintaining the harmony in the family.

CO 2: Create impulsive activities for healthy family

CO 3: Be receptive to troubled Individuals

CO 4: Gain healthy life by practicing Kundalini Yoga & Kayakalpa

CO 5: Possess Empathy among family members.

CO 6: Reason the life and its significance

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									S			
CO2							M					
CO3										M		
CO4												S
CO5						S						
CO6								M				

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

30 hours

Values through Practical activities:

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1. Family system: Introduction to Family Values – elements of family values - Adjustment, Tolerance, Sacrifice - Family structure in different society – work life balance.
2. Peace in Family : Family members and their responsibility - Roles of parents, children, grant parents -. Respectable women hood
3. Core value: Empathy: Unconditional love - Respect - Compassion - sacrifice–Care &share - helping – emotional support- hospitality – cleanliness
4. Blessing: Blessing - methods - Vibration effect - Benefits - Reason for misunderstanding in the Family and resolution through blessings.
5. Healthy Family: Good relationship with neighbors - Counseling - Simplified Kundalini Yoga - Kaya Kalpa Yoga

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 hours**

REFERENCES

1. FAMILY - www.download.nos.org/331courseE/L-13%20FAMILY.pdf
2. FRAMEWORK FOR ACTION ON VALUES EDUCATION IN EARLY CHILDHOOD – UNESCO – PDF –www.unesdoc.unesco.org/images/0012/001287/128712e.pdf
3. TRUE FAMILY VALUES Third Edition - Tparents Home www.tparents.org/Library/Unification/Books/TFV3/_TFV3.pdf
4. FAMILY VALUES IN A HISTORICAL PERSPECTIVE - The Tanner Lectures on www.tannerlectures.utah.edu/_documents/a-to-z/s/Stone95.pdf
5. PROBLEMS OF INDIA'S CHANGING FAMILY AND STATE ... - the United Nations - www.un.org/esa/socdev/family/docs/egm09/Singh.pdf

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SEMESTER IV

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U18MAT4101

NUMERICAL METHODS AND PROBABILITY

(Common to AE/AUE/CE/ME/MCE/EEE)

L	T	P	J	C
3	1	0	0	4

COURSE OUTCOMES

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

- **CO1:** Apply various numerical techniques for solving non-linear equations and systems of linear equations.
- **CO2:** Analyze and apply the knowledge of interpolation and determine the integration and differentiation of the functions by using the numerical data.
- **CO3:** Predict the dynamic behaviour of the system through solution of ordinary differential equations by using numerical methods.
- **CO4:** Solve PDE models representing spatial and temporal variations in physical systems through numerical methods
- **CO5:** Apply the concepts of probability to random variables
- **CO6:** Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.

Pre-requisite: NIL

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S										
CO2	S	S										
CO3	S	S							M			
CO4	S	S										
CO5	S	S							M			
CO6	S	S										

COURSE ASSESSMENT METHODS

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **9+3 Hours**

Linear interpolation method – Iteration method – Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordan methods - Iterative methods: Gauss Jacobi and Gauss - Seidel

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methods – Inverse of matrix by Gauss – Jordan method – Eigenvalues of a matrix by Power method.

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3 Hours

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's rules.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3 Hours

Single step methods: Taylor's series method – Euler and Improved Euler methods for solving a first order equations – Fourth order Runge-Kutta method for solving first and second order equations – Multistep method: Milne's predictor and corrector method.

BOUNDARY VALUE PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS 9+3 Hours

Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain–Solution of one dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes –Solution of one dimensional wave equation by explicit scheme.

PROBABILITY AND RANDOM VARIABLES 9+3 Hours

Axioms of probability - Conditional probability – Total probability – Bayes' theorem – Random variable – Distribution function – properties – Probability mass function- Probability density function – moments - Binomial, Poisson and Normal distributions – Properties.

Theory: 45 Hours Tutorials: 15 Hours Total: 60 Hours

REFERENCES

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi, 2007.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7th Edition, Tata McGraw-Hill, New Delhi, 2016.
4. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
5. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th edition, 2017.
6. Gupta S.C, and Kapur V.K "Fundamentals of Applied Statistics", Sultan Chand, New Delhi, 4th Edition, 2014.

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U18CEI4201	APPLIED HYDRAULICS AND HYDRAULIC MACHINERY	L	T	P	J	C
		3	0	2	0	4

Course Objectives

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
- At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering

Course Outcome

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

CO1: Apply the principles of open channel flow to design the most economical section of an open channel using standard flow equations.

CO2: Analyze critical flow conditions in open channels by examining velocity distribution, specific energy, and discharge parameters to assess flow behaviour.

CO3: Evaluate the effects of gradually varied flow in open channels by computing water surface profiles using methods like Direct Step and Graphical Integration.

CO4: Design efficient hydraulic machines, including turbines and pumps, based on operational conditions and performance criteria.

CO5: Assess the impact of flow dynamics in hydraulic machines such as pumps and turbines by evaluating their characteristic curves and efficiency.

CO6: Perform experiments in flow though pipes and analyze the performance characteristics of pumps and turbines.

Pre-requisites: U18CET3104 Fluid Mechanics

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	M	M	S				M	M	S	S	M
CO2	S	S	M	S	M		M			M	M		S	M
CO3	M	S	M	S	M		M			M	M		S	M
CO4	M	S	M	M	M	S		M		M	M		M	M
CO5	S	M	M	M	M	M	M			M	M		S	M
CO6	S	S	M	M	M	M				M	M		S	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

INTRODUCTION TO OPEN CHANNEL FLOW **9 Hours**

Comparison between open channel flow and Pipe flow; geometrical parameters of a channel; classification of open channels; classification of open channel flow; Velocity distribution in channel section.

UNIFORM FLOW **9 Hours**

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Continuity Equation; Energy Equation and Momentum Equation; Characteristics of uniform flow; Chezy's formula; Manning's formula; Factors affecting Manning's Roughness Coefficient 'n'; Most economical section of channel - Rectangular, Trapezoidal, Circular; Computation of Normal depth.

NON-UNIFORM FLOW **9 Hours**

Specific energy; Specific energy curve; critical flow; discharge curve; Specific force, Specific depth, and Critical depth; Gradually Varied Flow - Dynamic Equation of Gradually Varied Flow; Classification of channel bottom slopes; Classification of surface profile; Characteristics of surface profile; Computation of water surface profile; Direct Step method; Graphical Integration method; Hydraulic jump – Sequent depths; Flow through transitions (local bed rise and width contraction); Introduction to positive and negative surge

HYDRAULIC MACHINES **18 Hours**

Impact of Jets on moving plates; Classification of turbines and pumps; turbines – Pelton, Franics, Kaplan; draft tube; Pumps – Centrifugal, Reciprocating; indicator diagram; Air vessels; cavitation

PRACTICAL **30 Hours**

1. Estimate the losses in flow through a pipe
2. Estimate the time taken to empty a tank through an orifice and a mouth-piece
3. Estimate the discharge through a notch, venturimeter and an orifice
4. Simulate a Hydraulic jump
5. Estimate the characteristic curves for turbines – Kaplan, francis, pelton
6. Estimate the characteristic curves for pumps – centrifugal, reciprocating, gear oil
7. Demo on Bernoulli's apparatus and Reynolds Number apparatus

Theory: 45 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 75 Hours**

REFERENCES

5. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
6. P. N. Chandramouli, "Applied Hydraulic Engineering", Yes Dee Publishers, 2017
7. Modi & Seth, "Hydraulics and Fluid Mechanics", Standard Publishers.
8. R K Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 9th Edition, 2017.
9. C.S.P. Ojha, P.N. Chandramouli, and R. Berndtsson, "Fluid Mechanics and Machinery", Oxford University Press, 2010.

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U18CEI4202	HIGHWAY AND TRAFFIC ENGINEERING	L	T	P	J	C
		3	0	2	0	4

Course Objectives

This course aims at providing a comprehensive insight of various elements of Highway and traffic engineering. Topics related to the highway development, characterisation of different materials needed for highway construction, structural and geometric design of highway pavements along with the challenges and possible solutions to the traffic related issues will be covered as a part of this course.

On completion of the course, the students will be able to:

CO1 Apply principles of highway planning and alignment.
CO2 Analyze geometric design elements for highway engineering.
CO3 Evaluate traffic characteristics by various traffic surveys and design intersections.
CO4 Apply pavement material principles to pavement design.
CO5 Analyze pavement distress and and evaluate pavement condition using different evaluation techniques for effective maintenance.
CO6 Demonstrate proficiency in conducting laboratory experiments to test aggregate, bitumen, bituminous mixes, and pavement properties for pavement evaluation and traffic survey.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)												Programme Specific Outcome(PSO)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	S	S										M	M
CO2	S	S	S	S	M								M	M
CO3	S	S	S				M						M	
CO4	S	S	S	S	M								M	W
CO5	S	S	S	S			M						M	
CO6	S	S	S	S	W				M				M	

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

Highway Planning and Alignment 9 hours

Introduction to Highway Engineering - Highway development in India – Jayakar committee recommendations –road development plans- road classifications; Role of transportation in society; Institutions for highway development at national level-Current road programmes in India; highway alignment and surveys- Highway projects, Highway drawings and reports, Detailed Project Report preparation, PPP schemes of Highway Development in India, Government of India initiatives in developing the highways and expressways -Rural road development.

Geometric Design 9 hours

Highway cross section elements; sight distance, design of horizontal alignment; design of vertical

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alignment; problems, Special considerations for Hill roads. Clearance for Underpass.

Traffic Studies **9 hours**

Traffic Characteristics, Fundamentals of Traffic flow ; Traffic surveys - Speed, journey time and delay surveys -volume survey-origin-destination survey- Accident analysis- Level of Service and capacity, Channelization and intersections- types of at grade and grade separated intersections- design of rotary intersections; design of parking facilities; Traffic signs and road marking-highway lighting and road furniture –Traffic signal design.

Pavement Material and Design **9 hours**

Factors affecting pavement design- Pavement materials- Soil, Aggregate, bitumen; Bituminous paving mixes-Marshall stability mix design-Superpave mix design; Alternate materials for road construction-polymer modified bitumen-geotextiles-plastic roads;

Rigid and Flexible pavement- components and functions- design principles and factors – design of flexible pavement (IRC method only)-problem; design practice for rigid pavement-IRC recommendations.

Pavement Evaluation and Maintenance **9 Hours**

Pavement distress in flexible and rigid pavements; pavement condition survey- present serviceability index- pavement evaluation-roughnesss, skid resistance, structural evaluation, and evaluation by deflection measurements- Strengthening of pavements-overlay design. Highway Project formulation.

Theory: 45 Tutorial: 0 Practical: 30 Project: 0 Total: 75 Hours

PRACTICALS

LIST OF EXPERIMENTS **30 Hours**

1. **TESTS ON AGGREGATE**
   1. Determination of Aggregate Crushing Value
   2. Determination of Aggregate Abrasion Value
   3. Determination of Aggregate Impact Value
   4. Determination of Aggregate Soundness Value
   5. Determination of Aggregate Shape Value
   6. Determination of Aggregate-Bitumen Adhesion Value
   7. Determination of Specific gravity of Aggregate
   8. Determination of Aggregate Water absorption Value
2. **TESTS ON BITUMEN**
   9. Determination of Penetration value of Bitumen
   10. Determination of Softening Point of Bitumen
   11. Determination of Ductility Value of Bitumen
   12. Determination of Flash and fire points of Bitumen
   13. Determination of Viscosity of Bitumen
   14. Determination of Specific gravity of Bitumen
3. **TESTS ON BITUMINOUS MIXES**
   15. Determination of Binder Content by Centrifuge extractor
   16. Determination of Flow value of Bitumen by Marshall Stability Apparatus
4. **PAVEMENT EVALUATION**
   17. Determination of Deflection of pavement using Benkelman beam equipment
   18. Determination of Roughness value of pavement using Bump Integrator apparatus

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19. Determination of Skid Resistance of the pavement

5. **TRAFFIC SURVEY**
   20. Determination of Traffic Speed Characteristics
   21. Determination of Traffic Volume Characteristics

REFERENCES BOOKS

1. Khanna, S.K., Justo C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. Kadiyali L.R. and Lal N B, Principles and Practices of Highway Engineering; Seventh Edition, First Reprint; Khanna Publishers, New Delhi, 2018
3. Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,2016
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley, 2014
5. Subramaniam K.P, Highway Engineering, Scitech publications, 2016.
6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2014.
7. Sharma, S.K., Principles, Practice and Design of Highway Engineering, S. Chand & Co., New Delhi, 2015
8. Garber, N.J. and Hoel, L.A. Traffic and Highway Engineering, Fourth Edition; Cengage Learning, Stamford, CT, USA, 2010
9. Roger P. Roess, Elena S. Prassas and William R. McShane, Traffic Engineering 3rd Edition, Pearson Education International, 2013
10. https://nptel.ac.in/downloads/105101087/

Code of Provisions:
Design Codes: IRC 37-2012, IRC 58-2015, IRC 81-1997

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U18CEI4203 REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

L	T	P	J	C
2	0	2	0	3

Course Objectives

At the end of this course the student should have knowledge on concepts and applications leading to modelling of earth resources management using remote sensing and acquire skills in storing, managing digital data for planning and development skills in advance techniques for mapping, modelling and monitoring.

Course Outcomes

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

CO1: Apply the concepts of electromagnetic spectrum and atmospheric interactions to understand the fundamentals of remote sensing and evaluate their implications for data acquisition.

CO2: Analyze the characteristics and functionalities of various platforms and sensors to select appropriate tools for specific Earth observation applications.

CO3: Demonstrate image interpretation and analysis techniques to enhance and classify multispectral images for practical applications.

CO4: Interpret map projections and GIS components to analyze spatial and non-spatial data for effective map-based solutions.

CO5: Evaluate different data models and methods of data input and analysis to recommend suitable approaches for environmental and civil engineering applications.

Pre-requisites: Surveying and Geomatics

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		M		M							M	M	S
CO2	S		M		M							M	M	S
CO3	S		M		M							M	M	S
CO4	S		M		M								M	S
CO5	S		M		M						M	M	M	S

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

INTRODUCTION TO REMOTE SENSING 6 Hours

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan- Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts –typical spectral reflective characteristics of water, vegetation

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and soil

PLATFORMS AND SENSORS **6 Hours**

Types of platforms – orbit types, Sun- synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and space borne TIR and microwave sensors

IMAGE INTERPRETATION AND ANALYSIS **6 Hours**

Types of Data Products – types of image interpretation- basic elements of image interpretation- visual interpretation keys – Digital image processing – Pre-processing – image enhancement techniques – multispectral image classification – supervised and unsupervised.

GEOGRAPHIC INFORMATION SYSTEM **6 Hours**

Introduction – Maps- Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software – data type – Spatial and non-spatial (attribute) data – measurement scales- Data base Management Systems (DBMS).

DATA ANALYSIS **6 Hours**

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Application of GIS in highway- alignment studies, Environmental and water resources – land Information system.

PRACTICALS

LIST OF EXPERIMENTS **30 Hours**

1. Projection, Re-projection and Coordinate Transformation of Maps
2. Data Input – Onscreen Digitisation – Creation of Point, Line and Polygon layers
3. Attribute data input and Measurement of Distance, Area
4. Linking External Database and Tabular Data Analysis using SQL commands
5. Generating Graphs, Charts and Diagrams from Tabular data
6. Data Conversion – Vector to Raster and Raster to Vector
7. Map Joining, Edge Matching and Layout Design

Theory: 30	Tutorial: 0	Practical: 30	Project: 0	Total: 60 Hours

REFERENCES :

1. Ian Heywood "An Introduction to GIS", Pearson Education, Asia, 4th Edition 2012.
2. Lo.C.P and A.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition 2010.
3. Burrough P.A. and Rachel A. McDonell, "Principles of Geographical Information Systems", Oxford Publication, 3rd Edition 2016.
4. Thomas. M.Lillesand and Ralph. W. Kiefer, "Remote Sensing and Image Interpretation", John Wiley and Sons, 7th Edition 2015.
5. Basudeb Bhatta "Remote sensing and GIS" Oxford Publication, 2nd Edition 2011.

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U18CET4004	Strength of Materials	L	T	P	J	C
		3	0	0	0	3

Course Objectives

- To calculate the deflection in beams and trusses
- To assess the state of stress in three dimensions
- To determine the design loads for short and long column

Course Outcomes

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

CO1: Apply Castigliano's theorems and the principle of virtual work to compute deflections in beams and trusses.

CO2: Analyze the shear force and bending moment in propped cantilever beams, fixed beams, and continuous beams to determine internal stresses.

CO3: Distinguish between different states of stress and strain and infer the principal stresses and planes in 3D structures.

CO4: Evaluate the stability of columns under eccentric loading using Euler's theory and Rankine-Gordon formula.

CO5: Analyze the effects of unsymmetrical bending and shear flow in beams to determine stress concentrations and shear centers.

Pre-requisites : Solid Mechanics

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	-	-	-	-	-	-	-	-	-	-	M	-
CO2	M	M	S	-	-	-	-	-	-	-	-	-	-	-
CO3	-	S	-	S	-	-	-	-	-	-	-	-	M	-
CO4	S	S	-	-	S	-	-	-	-	-	-	-	-	-
CO5	M	-	S	-	S	-	-	-	-	-	-	-	-	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

ENERGY PRINCIPLES **8 Hours**

Stored energy in elastic members –traction, shear and flexure - Castigliano's theorems and principle of virtual work for computing deflections in beams and trusses - A peep into Finite element Method

INDETERMINATE BEAMS **8 Hours**

Analysis of propped cantilever, fixed beam and continuous beams

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GENERALIZED STATE OF STRESS AND STRAIN **8 Hours**

States of stress and strain – Differential equations of equilibrium of stress and strain - principal stresses and principal planes (3D) – Theories of elastic failure

COLUMNS **8 Hours**

Euler buckling- Members with eccentric loading- Rankine Gordon formula for eccentrically loaded columns.

ADVANCED TOPICS IN BENDING OF BEAMS **8 Hours**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – shear flow - shear centre - channel section - curved beams – Winkler Bach formula - stress concentration

VIRTUAL STUDY **5 Hours**

1. Deflection of Cantilever Beam and Plane trusses
2. Axially loaded Column
3. Principal stresses
4. Unsymmetrical bending of Beams
5. Creep , fracture and Fatigue strength
6. Graphical Solution – Mohr's Stress Circle
7. Model Making: Simple Plane Cantilever Truss

Theory:45 **Tutorial: 0** **Practical: 0** **Project:0** **Total: 45 Hours**

REFERENCES

1. Bansal R.K,"Strength of materials", Lakshmi publication, 2018.
2. Rajput R.K, "Strength of materials" (Mechanics of Solids), S. Chand, 2015.
3. Mechanics of Materials, BC Punmia & A.K. Jain, Laxmi Publications
4. Timoshenko, S. "Strength of Materials: Elementary theory and Problems", DVNC, New York, USA, 2004.
5. Kazmi, S. M. A., 'Solid Mechanics" Tata Mc- raw-Hill Publications Ltd, Delhi, 2009.
6. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
7. Structural Analysis, R. Agor, Khanna Publishing House
8. http://www.vlab.co.in

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U18INI4600 **ENGINEERING CLINIC - IV**

L	T	P	J	C
0	0	4	2	3

Course objectives

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

Course Outcomes

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

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite:U18INI3600

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	PSO2
CO1	S	S	S	S	S	M	W		S			S		M
CO2											S			
CO3										S				M

Course Assessment methods:

1. Project reviews 50%
2. Workbook report 10%
3. Demonstration & Viva-voce 40%

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the fourth semester, students will focus primarily on Reverse engineering project to improve performance of a product

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of Prototype.

Total Hours: 90

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U18CHT4000	Environmental Science and Engineering (Common to All branches)	L	T	P	J	C
		3	0	0	0	0

Course Outcomes

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

CO 1: Analyze the impact of engineering solutions in a global and societal context.

CO 2: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems.

CO 3: Highlight the importance of ecosystem and biodiversity.

CO 4: Consider issues of environment and sustainable development in his/her personal and professional undertakings.

CO 5: Paraphrase the importance of conservation of resources.

CO 6: Play an important role in transferring a healthy environment for future generations.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

	Programme Outcomes (POs)											
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		M					S		M			
CO 2						M				M		
CO 3							M					
CO 4						M	S					
CO 5							S					
CO 6			W				S					M

Course Assessment methods

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. End Semester Exam	Course end survey

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES **14 Hours**

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Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies – Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and overutilization of surface and ground water, conflicts over water, dams – benefits and problems – Water conservation, rain water harvesting, watershed management.

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, case studies.

Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Wasteland reclamation – Role of an individual in conservation of natural resources.

ECOSYSTEMS AND BIODIVERSITY **9**

Hours ECOSYSTEM: Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Food chain, Food web, Energy flow in the ecosystem and Ecological pyramids – Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

BIODIVERSITY: Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Bio geographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values – 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 – Organic and inorganic pollution – cyclone separator, electrostatic precipitator (b) Water pollution (c) Heavy metal pollution (d) Noise pollution (e) Thermal pollution (f) Nuclear hazards – Role of an individual in prevention of pollution – Pollution case studies – Solid waste and hazardous Management: Causes, effects and control measures from factories, small scale and large scale industries – Waste minimization – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7**

Hours From Unsustainable to Sustainable development – Urban problems related to energy – Resettlement and rehabilitation of people; its problems and concerns, case studies – Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest

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Conservation Act – Issues involved in enforcement of environmental legislation – Human Rights.

HUMAN POPULATION AND THE ENVIRONMENT **7 Hours**

Hours Population growth and explosion – Welfare Program – Environment and human health – Communicable disease – Role of Information Technology in Environment and human health – Case studies.

Theory: 45 Hours **Total: 45 Hours**

REFERENCES

1. G. Tyler Miller and Scott Spoolman, 'Environmental Science', Fourteenth Edition, Brooks Cole, 2012.
2. Gilbert M. Masters and Wendell P. Ela, 'Introduction to Environmental Engineering and Science', Third Edition, Pearson Education, 2013.
3. Bharucha Erach, 'The Biodiversity of India', Mapin Publishing Pvt. Ltd., Ahmedabad, 2002.
4. Trivedi R.K and P.K.Goel, 'Introduction to Air Pollution', Techno-Science Publications, 2003.
5. Trivedi R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media, 1996.
6. Cunningham, W.P.Cooper and T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publication House, Mumbai, 2001.
7. Wager K.D., 'Environmental Management', W.B. Saunders Co., Philadelphia, USA, 1998.
8. Colin R. Townsend, Michael Begon and John L. Harper, 'Essentials of Ecology', Third Edition, Blackwell Publishing, 2008.

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U18VEP4504	PROFESSIONAL VALUES	L	T	P	J	C
		0	0	2	0	1

Course Outcomes

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

CO 1: Develop the ethical values in both professional and personal life
CO 2: Develop ability to take decision to reinforce professional life
CO 3: Rational in professional skills required for diverse society
CO 4: Excel in ingenious attitude to congregate professional life
CO 5: Research into the professional stand
CO 6: Spruce an Individual with decorum to achieve professional life

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								S				
CO2				M								
CO3			S									
CO4												S
CO5								M				
CO6										M		

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

30 hours

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Values through Practical activities:

1. **Professional skills With Values:** Positive Attitude, Adaptability, Responsibility, Honesty and Integrity, Self Esteem, & Self Confidence

2. **Building Innovative work cultures:** Creative thinking, Critical thinking, Conflict Resolution, Problem Solving, & Decision making

3. **Professional Work Ethics:** Types of Ethics, Etiquette, personality Grooming, Emotional quotient, Human Dignity, Safety & Role of Professional in Social Responsibility

4. **Engineering Ethics:** Engineering Council of India - Objectives - Code of Ethics - Social responsibility -Professional Quality - Ethical issues - Effects - Strategy – Corruption, Consequences, Cures

5. **Case studies in engineering ethics:** Discussion of case studies relating to Public safety, health, welfare, Quality of product, Improper conduct by management, Product responsibility, Intellectual property

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 hours**

REFERENCES

1. LEARNING TO DO SOURCEBOOK 3 - UNESCO-UNEVOC - PDF www.unevoc.unesco.org/fileadmin/user_upload/pubs/LearningToDo.pdf

2. DECLARATION OF PROFESSIONAL VALUES AND ETHICAL STANDARDSwww.garda.ie/Documents/User/declarationvalues.pdf

3. KARMA YOGA - SWAMI VIVEKANANDA www.vivekananda.net/PDFBooks/KarmaYoga.pdf

4. PROFESSIONAL ETHICS IN ENGINEERING - Sasurie College of Engineering www.sasurieengg.com/.../GE2025%20Professional%20Ethics%20in%20Engineering.

5. ENGINEERING ETHICS CASE STUDY; Challenger www.ucc.ie/en/processeng/staff/academic/ebyrne/.../PE1006PptNotesLect7.pdf

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SEMESTER – V

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U18MBT5000 TOTAL QUALITY MANAGEMENT L T P J C

3 0 0 0 3

Course Objectives

To study and understand the various TQM principles, tools, techniques of quality control and assurances, International quality system documentation and auditing.

Course Outcomes

CO1: apply & analyze the various elements and concepts of TQM.
CO2: understand the various principles and philosophies of TQM
CO3: understand the fundamentals and process of statistics
CO4: apply and analyze the various quality tools, management tools to improve quality.
CO5:understand the various quality standards & systems, procedures for its implementation, documentation and auditing.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M									M	
CO2		M									M	
CO3	M	M			M					M	M	
CO4		M			S						M	
CO5					M					M	M	

Course Assessment methods

Direct

1. Continuous Assessment Test I,II
2. Assignment, Group Discussion
3. End semester Examination

INTRODUCTION 9 Hours

Definition of Quality, Dimensions of Quality, Quality Characteristics, Quality Improvement, History of Quality Control, Quality Circles, Obstacles to TQM Implementation.

TQM PRINCIPLES 9 Hours

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Customer Retention, Contributions of Deming, Juran, 5S, Kaizen, Just-In-Time

STATISTICAL PROCESS 9 Hours

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Statistical fundamentals- Measure of Central Tendency & Dispersion, population and sample, Basics of Control Charts.

TQM TOOLS **9 Hours**

The seven old tools of quality, New seven Management tools, Benchmarking, Taguchi quality loss function, CPM & PDPC, Building the house of quality, Quality Function Deployment (QFD), Concept of six sigma

QUALITY SYSTEMS & STANDARDS **9 Hours**

Introduction to ISO 9000, Clauses of ISO 9000, ISO Certification, Supplier quality issues, ISO 9001:2000 requirements, Quality Auditing , Quality Documentation.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Dale H.Besterfiled, "Total Quality Management", Pearson Education, 2016 .
2. Feigenbaum.A.V. "Total Quality Management", McGraw Hill, 2013.
3. James R.Evans& William M.Lidsay, "The Management and Control of Quality", South- Western (Thomson Learning), 2008.
4. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford, 2011.
5. Peter Pande "The Six Sigma Way" Tata McGraw Hill Book Co. Ltd., Delhi, 2000, 3rd Edition.
6. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 2007.
7. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers.2009
8. Bhaskar S. "Total Quality Management", Anuradha Agencies, Chennai. (2007-revised edition).

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U18CEI5201	ENVIRONMENTAL ENGINEERING	L	T	P	J	C
		3	0	2	0	4

Course Objectives

- To perform water characterization and to study the various water demand
- To learn the various unit process and operation of water and wastewater
- To understand the water distribution networks and plumbing system
- To estimate the sewage weather flow conditions and hydraulics of sewers

Course Outcome

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

CO1: Analyze and plan public water supply systems.
CO2: Design and optimize various components of water treatment plants.
CO3: Develop and maintain water distribution networks and service supply systems.
CO4: Assess and design efficient sewage flow systems.
CO5: Implement and manage sewage treatment solutions.

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M		M		M					M	M	
CO2	S	M	S		S		S						M	
CO3	M	S	S		S		M		M		M			M
CO4	M	M		S		M	S						M	
CO5				M		M	M	M		M		S		M

Course Assessment methods:

1. Continuous Assessment TestI, II and model examinations(Theory and Laboratory component)
2. Assignment and Laboratory experiments (Theory and Laboratory component)
3. End Semester Examination (Theory and Laboratory component)

PLANNING FOR WATER SUPPLY SYSTEM **10Hours**

Public water supply system – Planning - Objectives – Estimation of population forecasting and water demand – Sources of water and their characteristics – Water supply intake structures – types of pumps and its location- pipes and conduits for water. Pipe materials – transmission main lines – laying, jointing and testing of pipes

WATERTREATMENT **9 Hours**

Objectives of unit operations and processes – Principles, functions and design of plain sedimentation tanks, sedimentation cum coagulation tanks and sand filters – disinfection – Operation and maintenance of water treatment plants. Principles and functions of aeration – Iron and manganese removal, Defluoridation and demineralization – water softening - desalination – Reverse Osmosis.

WATER DISTRIBUTION AND SUPPLYTOBUILDINGS **7 Hours**

Service reservoirs –Network design – Analysis of distribution networks- Operation and maintenance – leak detection, methods. Principles of water supply in buildings – House service connection– Pipe appurtenances - Systems of plumbing and types of plumbing

SEWERDESIGN **9 Hours**

Sources of wastewater generation – Estimation of DWF & WWF –Hydraulics of flow in sewers – Design of sanitary and storm sewers – Sewers appurtenances – Sewage plumbing system for buildings - Effluent standards - Reclamation and reuse of sewage

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TREATMENTOFSEWAGE **10 Hours**

Objectives of sewage treatment and layout - Design of Screens, Grit chambers - Types of secondary

Treatment - Design of Activated sludge process and Trickling filter–Design of Septic tank with effluent disposal arrangements. Basic concepts on Advanced sewage treatment methods – Concepts on Sludge management.

PRACTICALS **30 Hours**

LIST OF EXPERIMENTS (for Water & Wastewater):

a. Introduction to Standards, Collection, Preservation of samples and Sampling Techniques – A Study Experiment
b. Determination of pH
c. Determination of Electrical conductivity
d. Determination of Turbidity
e. Determination of Acidity &Alkalinity
f. Determination of Hardness
g. Determination of Residual Chlorine and Available Chlorine
h. Determination of Sulphates
i. Determination of Chlorides
j. Determination of Optimum Coagulant Dosage
k. Determination of Solids
l. Determination of Oil and Grease
m. Determination of Dissolved Oxygen
n. Determination of Biochemical Oxygen Demand(BOD)
o. Determination of Chemical Oxygen Demand(COD)
p. Determination of Iron
q. Determination of Fluoride

Theory: 45 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 75 Hours**

REFERENCES

10. Garg, S.K., "Water supply Engineering", Khanna Publishers, 31st Edition ,2017
11. Garg, S.K., "Sewage Disposal and Air Pollution (Environmental Engineering II)", Khanna Publishers, 38th Edition2017.
12. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. "Environmental Engineering", Mc-Graw - Hill Indian Editions, New York 1st Edition2013.
13. "Manual on Water Supply and Treatment". Ministry of Urban Development, New Delhi,3rd Edition 2013
14. "ManualonSewerageandSewageTreatmentSystems,PartA,BandC".CentralPublicHealthand Environmental Engineering Organization, Ministry of Urban Development, 3rd Edition.2013
15. "APHA, AWWA Standard methods for the Examination of Water and Wastewater", American Public Health Association, Washington, D.C, 22nd Edition,2012.

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U18CEI5202	SOIL MECHANICS	L	T	P	J	C
		3	0	2	0	4

Course Objectives

The objective of the course is to understand, soil as an engineering material the load-deformation behaviour, through its index and engineering properties.

Course Outcomes

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

CO1: Apply Bureau of Indian Standards (BIS) guidelines to identify and classify soils based on engineering properties and index parameters.

CO2: Analyze effective stress and vertical stress distribution in soils using theoretical and empirical methods.

CO3: Evaluate soil permeability and seepage characteristics to design and interpret flow net diagrams for practical applications.

CO4: Assess compaction and compressibility parameters to predict total and time-rate settlements of soils under various loading conditions.

CO5: Analyze shear properties of cohesive and cohesionless soils.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M		M		M			M			S	
CO2	S	S	S	M	M		M			M		M	S	
CO3	S	S		S	M							M	S	
CO4	S	S		S			M					M	S	M
CO5	S	S	S			M	M	M				S	S	M

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

CLASSIFICATION OF SOIL **9 Hours**

Historical development of soil Engineering- Origin and general types of soils- soil structure, clay minerals- Three phase system and interrelationships- Identification and classification of soils (BIS classification).

EFFECTIVE STRESS AND VERTICAL STRESS DISTRIBUTION **9 Hours**

Soil water-capillary phenomena- concept of effective and neutral stresses- Vertical stress distribution in soil –Boussinesq and Westergaard's equation- Newmark'sinfluence chart – principle and application - equivalent point load and other approximate methods- pressure bulb.

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PERMEABILITY AND SEEPAGE **9Hours**

Permeability- determination of coefficient of permeability in the laboratory- Seepage flow- head, gradient, pressure- steady state flow- two dimensional- flow net.

COMPACTION, COMPRESSIBILITY AND CONSOLIDATION **9 Hours**

Compaction-laboratory and field compaction, Compressibility and consolidation- Terzaghi's one dimensional consolidation theory-pressure void ratio relationship- pre-consolidation pressure- total settlement and time rate of settlement- coefficient of consolidation- curve fitting methods.

SHEAR STRENGTH **9 Hours**

Shear strength- Mohr- Coulomb failure criterion- shear strength tests- different drainage conditions - shear properties of cohesive and cohesionless soil - Mohr's circle - principal stresses - Skempton's pore water pressure parameters.

PRACTICALS	**30 Hours**

LIST OF EXPERIMENTS

I. DETERMINATION OF INDEX PROPERTIES

1. Specific gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Grain size distribution Hydrometer analysis
4. Liquid limit and plastic limit tests
5. Shrinkage limit and Differential free swell tests.

II. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

6. Field density Test (Sand replacement method, Core cutter method)
7. Determination of moisture – density relationship using standard Proctor compaction test.

III. DETERMINATION OF ENGINEERING PROPERTIES OF SOIL

8. Permeability determination (Constant head and falling head methods)
9. Direct shear test in cohesionless soil
10. Unconfined compression test in cohesive soil
11. Laboratory vane shear test in cohesive soil
12. Tri-axial compression test in cohesion less soil (Demonstration)
13. One dimensional consolidation test (Determination of co-efficient of consolidation only) (Demonstration)

Theory: 45	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 75 Hours**

REFERENCES

1. Arora K.R., Soil Mechanics and Foundation Engineering, Standard Publishers and Distributors, New Delhi., 2014.
2. Punmia B. C., Jain A. K., and Jain A. K. "Soil Mechanics and Foundations", Laxmi Publications, New Delhi 2017.
3. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, Wiley eastern ltd, New Delhi., 2014.
4. Murthy, V. N. S., Soil Mechanics and Foundation Engineering, CBS Publishers Distribution Ltd., New Delhi., 2011.
5. Das, B. M, Principles of Geotechnical Engineering, Thompson Brooks/ Coles

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U18CET5103	STRUCTURAL ANALYSIS	L	T	P	J	C
		3	1	0	0	4

Course Objectives

- To understand the concept of indeterminacy, analyze beams and frames using matrix methodsand moment distribution method
- To learn the concepts of moving loads and its effect on structures
- To learn the concept and analysis of cable stayed bridges
- To analyze the behavior of parabolic arches

Course Outcome

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

CO1: Apply concepts of static and kinematic indeterminacy to distinguish between determinate and indeterminate structures and analyze their equilibrium conditions.

CO2: Analyze continuous beams considering with and without sinking of supports and single storey portal frames considering with and without sway using moment distribution method.

CO3: Utilize matrix flexibility and stiffness method to analyze indeterminate pin-jointed and rigid-jointed plane frames, continuous beams.

CO4: Apply the concept of influence lines to analyze beams under moving loads and determine critical load positions for maximum bending moment and shear force.

CO5: Analyze arches under different loading conditions, considering factors like settlement and temperature effects and cables with stiffening girders.

Pre-Requisite: **U18CET4004 Strength of Materials**

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M	S	M	M		W				M	S	M
CO2	S	S	M	S	M	M		W				M	S	M
CO3	S	S	M	S	M	M		W				M	S	M
CO4	S	S	M	S	M	M		W				M	S	M
CO5	S	S	M	S	M	M		W				M	S	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

BASIC CONCEPTS **5 Hours**

Introduction –Static Indeterminacy and Kinematic Indeterminacy – Determinate vs Indeterminate Structures - Equilibrium and Compatibility conditions - Force and Displacement methods of analysis.

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MOMENT DISTRIBUTION METHOD **8 Hours**

Distribution and carryover of moments – Stiffness and carry over factors - Analysis of continuousbeams - sinking of supports - Single storey portal frames with and without sway.

MATRIX FLEXIBILITY METHOD **8 Hours**

Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (withredundancy restricted to two).

MATRIX STIFFNESS METHOD **8 Hours**

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacement vectors – Analysis of pin-jointed plane frames, continuous beams and rigid frames (with redundancy limited totwo)

MOVING LOADS AND INFLUENCE LINES **8 Hours**

Introduction to moving loads – Concept of influence lines - Construction of Influence lines for reaction, shear force and bending moment for rolling loads in simply supported and overhanging beams - Analysis for different types of moving loads - Computation of load positions for maximum bending moment and maximum shear force - absolute maximum bending moment. Muller-Breslau's principle, Construction of ILD for continuous beams.

ARCHES AND CABLES **8 Hours**

Arches as structural forms – Types of arches – Eddy's theorem- Analysis of three hinged and two hinged parabolic arches- Settlement and temperature effects. Analysis of suspension cables - cables with two hinged stiffening girders, cables with three hinged stiffening girders.

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

REFERENCES

1. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications Pvt.Ltd., New Delhi, 13th Edition 2017.
2. Reddy.C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt.Ltd., New Delhi, 3rd Edition2013.
3. Vaidyanadhan R and Perumal, P, "Comprehensive Structural Analysis-Vol.1 &Vol.2", LaxmiPublications Pvt.Ltd, New Delhi,4th Edition 2018.
4. Bhavikatti.S.S, "Structural Analysis-Vol.1 & Vol.2", Vikas Publishing Pvt Ltd., New Delhi. 4th Edition2014.
5. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing HousePvt.Ltd.,New Delhi, 2014.
6. Chandramouli P.N., "Structural Analysis I", Yesdee Publishing Pvt Ltd., Chennai, 1st Edition 2015.
7. R.C. Hibbeler, Structural Analysis, 5th Edition, Pearson Education, 6th Edition, 2010.
8. Devadas Menon, "Structural Analysis", Narosa Publishing House, 2nd Edition 2014.
9. Wang C.K. , "Indeterminate Structural Analysis", Tata McGraw Hill Education Pvt. Ltd.,

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U18CET5005	CONCRETE TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

Course Objectives

- To gain knowledge about the various ingredients used in concrete.
- To understand tests done on fresh and hardened concrete properties.
- To design concrete mix proportion using IS code.

Course Outcome

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

CO1: Understand the types, chemical compositions, and properties of cement and aggregates, and explain their role in concrete production.

CO2: Analyze the effects of chemical and mineral admixtures on the properties of concrete, and compare their impact on concrete performance.

CO3: Apply the principles of mix proportioning to design concrete mixes and demonstrate the application of BIS Mix Design methods.

CO4: Evaluate the workability and strength properties of fresh and hardened concrete, and assess their influence on concrete quality.

CO5: Evaluate the suitability and performance of various special concretes such as high-strength, fiber-reinforced, and self-compacting concrete.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M			M		M	M		S		S		
CO2	S	S	S	M	S		S	M	M	S	S	S	S	M
CO3	M	S	M	S	M		M	S		M	S	S	S	M
CO4	S	S	S	M	S		S	S	M			M	S	M
CO5	M	M	S	M	M		M			M		M	M	S

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

CONSTITUENT MATERIALS **9 Hours**

Cement - Types - Chemical compositions and properties - Tests on cement - IS Specifications – Aggregates – Classifications - Mechanical properties and tests as per BIS Grading requirements – Water - Quality of water for use in concrete.

CHEMICAL AND MINERAL ADMIXTURES **9 Hours**

Accelerators, Catalysts, Retarders, Plasticizers, Super-plasticizers, Water proofers, Mineral

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Admixtures like Fly ash, Slica fume, Ground Granulated Blast Furnace Slag, Copper slag and Metakaolin - Effects on concrete properties.

PROPORTIONING OF CONCRETE MIX **9 Hours**

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples.

FRESH AND HARDENED PROPERTIES OF CONCRETE **9 Hours**

Workability - Tests for workability of concrete - Slump Test and Compacting factor Test - Segregation and Bleeding - Properties of Hardened concrete: Determination of Compressive and Flexural strength as per IS code - Stress-strain curve for concrete - Determination of Young's Modulus of elasticity for concrete.

SPECIAL CONCRETES **9 Hours**

Light weight concrete - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – Self compacting concrete - Shotcrete – Polymer concrete - High performance concrete- Geo-polymer Concrete – 3D concrete printing.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2015.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2016.
3. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007.
4. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995.
5. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2015.
6. IS10262-2019 Concrete Mix Proportioning Guidelines, Bureau of Indian Standards, New Delhi, 2019

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U18CEP5604	SURVEY CAMP	L	T	P	J	C
		0	0	0	0	1

Course Objectives

- Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
- Translate the knowledge gained for the implementation of Civil infrastructure facilities

Course Outcomes

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

CO1: perform survey as per the field condition

CO2: conduct LS and CS by using advanced equipment

CO3: prepare contour map for the given area

CO4: prepare topographical survey and mark the building

Pre-requisites : U18CEI3202 : Engineering Survey

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				S	S					M			S	
CO2				S	S					M			S	
CO3				S	S					M			S	
CO4				S	S					M			S	

Course Assessment methods

Course Type	End semester components		
	Average of Pre/post-test/ Viva for each experiment	Average of marks for experiment report for each Exp.	Practical exam Viva -voce
Lab	20	30	50

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One week survey camp carried out over a large area for area measurements, leveling and angular measurements. At the end of the camp, each student will independently completethe office work for the survey works done in the field. The camp record shall include all original field observations, calculation and plots. Conventional surveying for Civil Engineering project works

a. Topographical survey
b. Contour Surveying, L.S/C.S for road works.
c. Building survey (column marking)
d. Total station surveying to plot a boundary

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U18VEP5505	SOCIAL VALUES	L	T	P	J	C
		0	0	2	0	0

Course Outcomes

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

CO 1: Understand the transformation from self to society

CO 2: Acquire knowledge about disparity among Human Beings

CO 3: Realize the new ethics in creating a more sustainable Society

CO 4: Develop skills to manage challenges in social issues

CO 5: Acquire the skills for Management of Social work & Holistic Society

CO 6: Validate the social liabilities at dissimilar situations

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES
4. U18VEP4504 / PROFESSIONAL VALUES

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						S						
CO2							S					
CO3								M				
CO4											S	
CO5												S
CO6									M			

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

Values through Practical activities: **30 hours**

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1. Self and Society: Relation between self and society – Different forms of society - Elements of Social structures – Realization of Duties and Responsibilities of Individual in the Society

2. Social Values: Tolerance – Responsibility – Sacrifice – Sympathy - Service – peace-nonviolence - right conduct- Unity – forgive – dedication – Honest

3. Social issues : Disparity among Human beings- Poverty-Sanitation -corruption- un employment-superstition – religious intolerance & castes – terrorism.

4. Emerging Ethics for Sustainable Society: Unison of Men in Society - Positive Social Ethics - Cause and Effect - Ensuring an Equitable Society- Effect of Social Media in society - development of Education and Science in the Society

5. Social Welfare: Social welfare Organization - Programme by Government and NGO's - Benefits of Social Service - Balancing the Family and Social Life – Development of Holistic Society

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 hours**

REFERENCES

1. SOCIAL PROBLEMS IN INDIA - ForumIAS.com – PDF
   discuss.forumias.com/uploads/File upload/.../711b18f321d406be9c79980b179932.pd...

2. INVESTING IN CULTURAL DIVERSITY AND INTERCULTURAL DIALOGUE: UNESCO ...
   www.un.org/en/events/culturaldiversityday/pdf/Investing_in_cultural_diversity.pdf

3. INDIAN SOCIETY AND SOCIAL CHANGE - University of Calicut
   www.universityofcalicut.info/SDE/BA_sociology_indian_society.pdf

4. CULTURE, SOCIETY AND THE MEDIA - E- class
   www.eclass.uoa.gr/.../MEDIA164/.../%5BTony_Bennett,_James_Curran,_Michael_G

5. SOCIAL WELFARE ADMINISTRATION - IGNOU
   www.ignou.ac.in/upload/Bswe-003%20Block-2-UNIT-6-small%20size.pdf

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SEMESTER – VI

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U18CEI6201	DESIGN OF MASONRY AND REINFORCED CONCRETE ELEMENTS	L	T	P	J	C
		3	0	2	0	4

Course Outcomes

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

CO1: Apply principles of masonry wall classification and lateral support to analyze their stability and design of axially and eccentrically loaded brick walls.

CO2: Design singly and doubly reinforced rectangular and flanged beams, one-way and two-way slabs for various loading and boundary conditions and design of staircases.

CO3: Analyze the behaviour of RC members in bond and anchorage and design RC members for combined bending, shear, and torsion.

CO4: Design short rectangular and circular columns, slender compression members for axial, uniaxial, and biaxial bending.

CO5: Design various types of footings for axial and eccentric loading.

CO6: Demonstrate proficiency in using design software for analyzing and designing RC elements, framed multi-storied buildings and steel trusses.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	M	M	W	W	W	W	M	W	S	S	M
CO2	S	S	S	M	M	W	W	W	W	M	W	S	S	M
CO3	S	S	S	M	M	W	W	W	W	M	W	S	S	M
CO4	S	S	S	M	M	W	W	W	W	M	W	S	S	M
CO5	S	S	S	M	S	W	W	W	W	M	W	S	S	M
CO6	S	S	S	M	M	W	W	W	W	M	W	S	S	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

MASONRY 8 Hours

Introduction, Classification of walls, Lateral supports and stability, effective height of wall an columns, effective length of walls, design loads, load dispersion, permissible stresses, design o axially and eccentrically loaded brick walls.

METHODS OF DESIGN OF CONCRETE STRUCTURES 5 Hours

Methods of design - advantages of Limit State Method over other methods- Design codes and specification

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DESIGN FOR FLEXURE **8 Hours**

Analysis and design of singly and doubly reinforced rectangular and flanged beams- Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.-design of staircase

DESIGN FOR BOND, ANCHORAGE, SHEAR & TORSION **9 Hours**

Behaviour of RC members in bond and Anchorage- Design requirements as per IS code- Behaviour of RC beams in shear and torsion- Design of RC members for combined bending, shear and torsion.

DESIGN OF COLUMNS **9 Hours**

Types of columns- Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending – Design of slender compression members

DESIGN OF FOOTING **6 Hours**

Design of wall footing – Design of axially and eccentrically loaded rectangular isolated footing– Strap footing -Design of combined footing- rectangular and trapezoidal

PRACTICALS	**30 HOURS**

1. Introduction about design software.
2. Illustrate data/Multiple analysis for RC elements like column, Beam, RC slab, Footing.
3. Nonlinear analysis of Beams and Columns
4. Analysis and Design of trusses
5. Analysis and Design of Simply supported beams ,Fixed beams, Continuity beams.
6. Analysis and Design of Columns for various supporting conditions.
7. Analysis and Design of RCC framed multi-storied building.

Theory:45	**Tutorial:0**	**Practical:30**	**Project :0**	**Total: 75Hours**

REFERENCES

1. Gambhir.M.L., Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private limited, New Delhi, 4th Reprint 2011.
2. Varghese, P.., "Limit state Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2nd Edition 2013.
3. Subramanian, N. Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 1st Edition 2013.
4. Punmia, B.C., Ashok Kumar jain, Arun Kumar jain, "Limit state Design of Reinforced concrete, Laxmi Publications Pvt. Ltd., New Delhi, 1st Edition 2007.
5. Sinha, S.N., " Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition 2004.
6. I.C.Syal and A.K.Goel, "Reinforced Concrete Structures", S.Chand and Company Ltd, New Delhi, 4th Edition 2007.
7. Pillai & Menon ."Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi 2014.

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U18CEI6202	CONSTRUCTION PROJECT MANAGEMENT	L	T	P	J	C
		3	0	2	0	4

Course Objectives

This course will help the students to understand how to manage the three important essentials of a construction project such as time, cost and scope.

Course Outcome

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

CO1: Apply the principles of project management to explain the life cycle of construction projects.

CO2: Analyze project planning techniques to construct bar charts and CPM/PERT networks for scheduling.

CO3: Evaluate resource allocation methods to determine optimized schedules under constraints.

CO4: Analyze the relationship between time, cost, and project activities to propose optimal crashing strategies.

CO5: Recommend quality and safety control measures by interpreting statistical methods for construction projects**.**

CO6: Demonstrate the use of Primavera software to create, update, and analyze project schedules effectively.

Pre-requisites : Solid mechanics

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M			S	S				M					S
CO2		S	S		M	W	M					M		M
CO3	M		S	M	S		M		M		S			S
CO4			S					M		M	S	M	M	
CO5	S	S		M		S			M		S	M	M	S
CO6		M			W			S		S	M	S		S

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

INTRODUCTION AND SCOPE OF PROJECT MANAGEMENT 9 Hours

Context of construction management - characteristics of the construction industry - domestic and global construction market - Definition of a project - Nature of construction projects, project life-cycle - Principles of project management, project management functions- project scope management -Elements of cost estimation - Estimating methods -Project budgeting, bidding.

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PROJECT PLANNING AND SCHEDULING 9 Hours

Bar chart planning – CPM Network construction : Activities and events, logic and interdependence in network, time computations, critical period and path, floats – PERT

Network : time estimates, Beta distribution, expected time, standard deviation, probability of achieving desired time targets for projects-introduction to project management softwares

RESOURCE ALLOCATION 9 Hours

Resource aggregation diagrams as per early start and late start - smoothing by activity start time manipulation - Levelling of resources according to constraints - priorities of activities - sort rules - Minimum project duration subject to resource constraint

TIME COST OPTIMIZATION 9 Hours

Direct and Indirect costs and their relation to time – Activity crashing – Normal and Crash duration and corresponding cost of activities – Cost slope – Crashing of network to optimize cost and duration of a project – Operations Research Technique to optimize assignment of tasks to groups of workmen, transport of materials quarries to sites.

QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9 Hours

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and

PRACTICALS	**30 HOURS**

Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

Primavera P6 Professional - Navigation in PPM module – EPS & OBS – Calendar usage in projects – Project creation – WBS – Creation of activities in projects – Sequencing – Scheduling – Assigning resource units and costs – Codes – Baseline – Progress update – Earned value management - Reports

Theory:45	**Tutorial:0**	**Practical:30**	**Project: 0**	**Total: 75Hours**

REFERENCES

1. Punmia B C and Khandelwal K K, "Project Planning and Control with PERT and CPM", Laxmi Publications, 2016.
2. Dr.S.Seetharaman, "Construction Engineering and Management", Umesh Publications, 2015.
3. Chitkara, K.K. "Construction Project Management Planning, Scheduling and Control", Tata McGraw-Hill Publishing Co., New Delhi, 2014.
4. Srinath L S, "PERT/CPM Principles and Applications", Affiliated East West Press (P) ltd, 2002.
5. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pitsburgh, 2000.

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U18CET6003 FOUNDATION ENGINEERING

L	T	P	J	C
3	0	0	0	3

Course Objectives

At the end of the course student will be able to suggest and design a suitable foundation for a structure depending on the type of soil. Also understand and analyze different types of earth pressure and perform stability checks for retaining wall.

Course Outcomes

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

CO1: Apply the methods of soil exploration, including auguring, boring, and rotary drilling for site investigation.

CO2: Analyze the bearing capacity of shallow foundations based on Terzaghi's formula, IS code method and in-situ test results, and evaluate the settlement of foundations on granular and clay deposits.

CO3: Evaluate the selection and design of shallow foundations, including mat foundations based on site conditions and codal provisions.

CO4: Analyze the load-carrying capacity and settlement of pile foundations, including single and pile groups, using various methods such as static and dynamic formulae,and assess the efficiency of pile groups.

CO5: Evaluate the earth pressure distribution and stability analysis of retaining walls using Rankine's theory and Culmann's graphical method, and use of geosynthetics in retaining wall as reinforcement.

Pre-requisites : U18CEI5103-Soil Mechanics

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs			Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	W								M	S	M	M	M	M
CO2	S	S		W		M		M			S	S	S	W
CO3	S	S	S			M		S			M	S	S	
CO4	S	M	M	W		M					S	S	S	
CO5	S	M	M		W	M		S			M	W	M	

Course Assessment Methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

SITE INVESTIGATION AND SELECTION OF FOUNDATION 8Hours

Scope and objectives – Methods of exploration – auguring and boring – wash boring and rotary drilling – Depth of boring- spacing of bore hole – sampling techniques –

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representative and undisturbed sampling- methods- different types of samplers– Bore log report –data interpretation- strength parameters and liquefaction potential – Selection of foundation based on soil condition.

BEARING CAPACITY AND SETTLEMENT **10 Hours**

Introduction- Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems – Bearing capacity from in-situ tests (plate load, SPT and SCPT) Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of settlement of foundations on granular and clay deposits – Total and differential settlement.

SHALLOW FOUNDATION **7 Hours**

Types of footings – Contact pressure distribution, isolated footing – combined footings – proportioning – Mat foundation – Types and applications- Floating foundation – Codal provision (No structural design).

PILE FOUNDATION **10 Hours**

Types of piles and their function – Factors influencing the selection of pile – Load carrying capacity of single pile in granular and cohesive soil – static formula - dynamic formula – Capacity from insitu tests – negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse-Labarre formula and block failure criterion) – Settlement of pile groups –Pile load tests – Under reamed piles.

RETAINING WALLS **10 Hours**

Plastic equilibrium in soils – active and passive states- Rankine's theory – cohesionless and cohesive soil –Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann's Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls - Use of geosynthetics for different applications.

REFERENCES

Theory: 45 Tutorial: 0 Practical: 0 Project: 0 Total: 45Hours

1. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, new Delhi, 7th Edition 2014.
2. Punmia, B. C., Jain, A. K., and Jain, A. K. "Soil Mechanics and Foundations",Laxmi Publications, New Delhi,17th Edition:2017
3. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley easternltd, New Delhi, 2nd Edition 2014.
4. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 5th Edition 2011.
5. Das, B.M, "Principles of Geotechnical Engineering", Thompson Brooks/ ColesLearning, Singapore, 5th Edition, 2002.

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U18CET6004 DESIGN OF STEEL STRUCTURES L T P J C
3 0 0 0 3

Course Objectives

This course aims at imparting knowledge to the students on the design concepts and methods of design of various steel structural elements like compression members, tension members, flexural members and design of trusses members and also to gain knowledge on the design of welded and bolted joints used in steel structures.

Course Outcomes

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

CO1: Design the bolted and welded joints for steel structures.
CO2: Design steel tension members using plates and angle sections
CO3: Design steel compression members like simple columns, built up columns and angle struts and column bases.
CO4: Design flexural members like beams and plate girders
CO5: Evaluate the various loads acting and design the truss band design the truss members and purlins.

Pre-requisites : U18CEI3201-Soilid Mechanics

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		S	M									M	
CO2	S		S	M									M	
CO3	S		S	M									S	
CO4	S		S	M									M	
CO5	S		S	M										

Course Assessment Methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

DESIGN METHODS AND CONNECTIONS FOR STEEL MEMBERS 12 Hours

Introduction: Properties of Indian standard rolled steel sections, limit state method of design-partial safety factors-general codal requirements.

Bolted Connections: Types- force transfer mechanism of bearing type and HSFG bolts-design in direct compression, tension-moment in plane of the bolt-moment perpendicular to the bolt.

Welded connections: Types of welded joint, design in direct compression, tension-moment in plane of the weld-moment perpendicular to the plane of weld.

STEEL TENSION MEMBERS 06 Hours

Behaviour and mode of failure-Design -plates -single and double angle- Lug angle

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STEEL COMPRESSION MEMBERS **09 Hours**

Type of column sections-design –rolled steel section-built-up section-laced and battened columns-Angle struts. Column base: slab base and gusseted base.

STEEL FLEXURE MEMBERS **09 Hours**

Behaviour- Design-simple and compound beams-laterally restrained – Laterally unrestrained beams–Factors affecting lateral stability- built-up beams-design of plate girder.

DESIGN OF TRUSSES **09 Hours**

Introduction-Evaluation of design dead load, live load, wind load, design of truss using rolled steel sections-purlins-truss members-supports.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. Jayagopal L.S, Tensing D, " Design of steel structures" Vikas Publishing House (2015)
2. Nehi L.S " Design of steel structures" McGraw Hill Co, New Delhi, 2014.
3. Teaching Resource for Structural Steel design Vol1,2,3(2000) INSDAG-Institute for Steel Development and Growth, Kolkatta.
4. Subramanian N (2008) Design of Steel Structures, Oxford University Press, USA.
5. Duggal S.K, "Limit state design of steel structures", McGraw Hill Co., New Delhi, 2014.
6. IS 800-2007-Code of practice for general Construction in steel
7. SP6(1) Hand book for Structural Engineers- Part I: Structural Steel sections, BIS.

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U18CER6705 **INPLANT TRAINING**

L	T	P	J	C
0	0	0	0	1

Course Outcomes

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

CO1 handle and execute the civil engineering projects in the field.
CO2 calculate the spirit of team work
CO3 plan for material and manpower resources management.
CO4 prepare project report.

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1										S		M		S
CO 2									S		S	M		S
CO 3											S	M	S	
CO 4										S		M	S	

Course Assessment Methods

1. Project report
2. Oral presentation

Course objectives:

Students have to undergo two-week practical training in Civil Engineering related organizations so that they become aware of the practical applications of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Civil Engineering related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment Process:

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

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U18INT6000	CONSTITUTION OF INDIA (Mandatory course)	L	T	P	J	C
		2	0	0	0	0

Course Outcomes:

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

CO 1: Gain Knowledge about the Constitutional Law of India
CO 2: Understand the Fundamental Rights and Duties of a citizen
CO 3: Apply the concept of Federal structure of Indian Government
CO 4: Analyze the Amendments and Emergency provisions in the Constitution
CO 5: Develop a holistic approach in their life as a Citizen of India

Pre-requisites: **NIL**

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M			W			S
CO2						S		S				M
CO3									M	S		W
CO4								W	M			M
CO5						M		M				S

Course Assessment methods

1. Group Activity / Quiz/ Debate / Case studies
2. Class test / Assignment

Module.1: Introduction to Indian Constitution **4 hours**

Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution - Salient features and characteristics of the Constitution of India

Module.2: Fundamental Rights **8 hours**

Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - Scope of the Right to Life and Liberty - Fundamental Duties and its legal status - Directive Principles of State Policy – Its importance and implementation

Module.3: Federal Structure **8 hours**

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India

Module.4: Amendment to Constitution **6 hours**

Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India

Module.5: Emergency Provisions **4 hours**

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National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India

Theory: 30	Tutorial: 0	Practical: 0	Project: 0	Total: 30 hours

REFERENCES

1. Constitution of India - Ministry of Law & Justice – PDF format
   awmin.nic.in/coi/coiason29july08.pdf
2. Introduction to the Constitution of India by Durgadas Basu
3. The Constitution of India – Google free material -
   www.constitution.org/cons/india/const.html
4. Parliament of India – PDF format
   download.nos.org/srsec317newE/317EL11.pdf
5. The Role of the President of India – By Prof.Balkrishna
6. Local Government in India – E Book - Pradeep Sachdeva
   https://books.google.com/books/.../Local_Government_in_In...

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U18VEP6506	NATIONAL VALUES_	L	T	P	J	C
		0	0	2	0	0

Course Outcomes

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

CO 1: Acquire knowledge on the Cultural Heritage of India
CO 2: Know the great Indian personalities and follow their trail
CO 3: Understand the specialty of democracy
CO 4: Disseminate our Nation and its values to propagate peace
CO 5: Contribute with their energy and effort for a prosperous India
CO 6: Propagate the youth and the contribution for development of our Nation

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES
4. U18VEP4504 / PROFESSIONAL VALUES
5. U18VEP5505 / SOCIAL VALUES

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						S						
CO2									M			
CO3							M					
CO4								S				
CO5											S	
CO6												M

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

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Values through Practical activities: **30 hours**

1. Cultural Heritage of India : Indian Unity in Diversity – Universalism - Languages and Literatures - Religion and Philosophy - Art and Architectures.
2. Great Indian Leaders : Ancient rulers - Freedom fighters - Social reformers -Religious and Spiritual leaders - Noble laureates -Scientists – Statesman.
3. Largest Democracy : Socialist -Secular - Democratic and Republic – special features of Indian constitution – Three pillar of Indian democracy - Fundamental rights – Duties of a citizen – centre state relationship.
4. India's Contribution to World peace : Nonaligned Nation – Principle of Pancha Sheela – Mutual respect, non-aggression, non-interference, Equality and cooperation – Role of India in UNO -Yoga India's gift to the world.
5. Emerging India : World's largest young work force - Stable Economic development - Labor market & Achievement in space technology – Value based Social structure. Emerging economic superpower.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 hours**

REFERENCES

1. CULTURAL HERITAGE OF INDIA - SCERT Kerala
   www.scert.kerala.gov.in/images/2014/HSC.../35_Gandhian_Studies_unit-01.pdf

2. LEARNING TO DO: VALUES FOR LEARNING AND WORKING TOGETHER - UNESCO
   www.unesdoc.unesco.org/images/0014/001480/148021e.pdf

3. INDIA AFTER GANDHI.pdf - Ramachandra Guha - University of Warwick
   www2.warwick.ac.uk/fac/arts/history/students/modules/hi297/.../week1.pdf

4. INDIA'S CONTRIBUTION TO THE REST OF THE WORLD - YouSigma
   www.yousigma.com/interesting facts/indiasgifttotheworld.pdf

5. INDIA AS AN EMERGING POWER - International Studies Association
   web.isanet.org/Web/Conferences/.../11353cac-9e9b-434f-a25b-a2b51dc4af78.pdf

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SEMESTER – VII

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U18CET7001 **ESTIMATION,COSTING AND VALUATION**

L	T	P	J	C
3	0	0	0	3

Course Objectives

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

Course Outcome

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

CO1: Analyze estimation techniques to differentiate and calculate quantities for buildings, roads, and other civil structures using relevant methods

CO2: Analyze the rate analysis process by comparing observed and standard data to accurately cost civil engineering projects.

CO3: Apply the principles of specifications, report preparation, and tender procedures to prepare effective documentation for civil projects.

CO4: Apply the principles of contract formation and management to draft and manage contract documents effectively in civil engineering.

CO5: Analyze valuation methods to interpret the financial worth of various civil engineering assets and prepare valuation reports

Pre-requisites:Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		S		M			S		S	S		S	
CO2	M	M	M		M		M					S		M
CO3			S	M				S		M			S	
CO4			M			M			W			M		M
CO5		W					M				M	S	S	

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

QUANTITY ESTIMATION **9 Hours**

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads septic tank, soak pit, retaining walls –culverts - Preparation of Bar Bending Schedules (additional practice in classroom using computer softwares).

RATE ANALYSIS AND COSTING **9 Hours**

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Standard Data – Observed Data – Schedule of rates – Market rates – Standard Data for Man Hours and Machineries for common civil works–Rate Analysis for all Building works, canals, and Roads– Cost Estimates(additional practice in class room using Computer softwares) - (Analysis of rates for the item of work asked ,the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

SPECIFICATIONS, REPORTS AND TENDERS **9 Hours**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTTAct2000 – Tender notices – types – tender procedures – Drafting model tenders, E-tendering – Digital signature certificates – Encrypting – Decrypting – Reverse auctions.

CONTRACTS **9 Hours**

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD /MORTH Standard bidding documents – Construction contracts – Turnkey Projects – Contract problems – Arbitration and legal requirements. Unit of Measurement & Conversion Factors & Learning the methods of Measurements as per Codes

VALUATION **9 Hours**

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalized value – Depreciation – Escalation –Valuation of land–Buildings –Calculation of Standard rent – Mortgage –Lease - Interpretation of Good for Construction Drawings & Understanding the Engineering inputs.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. Rangalwala S C “Estimating, costing and valuation ”,Charotar Publishing House”2017 17th Edition 2017 (First Reprint) (Revised) ISBN : 9789385039058
2. Dutta .B.N “Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuations” (2017)
3. R.C.Kohli “A Textbook of Estimating ,Costing & Accounts (Civil)” S. Chand Publishing year-2013
4. A.K. Upadhyay “Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation” 2013
5. G. B. Deshpande (Author), J. P. Nayak “Quantity surveying, contracts and tenders” 2012
6. B.N.Suresh “Estimating and Costing” First Edition 2006
7. https://study.com/articles/Online_Quantity_Surveying_Courses_and_Classes.html
8. Indian institute of valuation(http://iivindia.org/)
9. Dutta .B.N”Estimation and Costing in civil Engineering,27th Edition -2011
10. Hand Book of Consolidated Data –8/2000, Vol.1,TNPWD
11. Tamil Nadu Transparencies in Tenders Act, 1998

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12. Arbitration and Conciliation Act, 1996
13. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
14. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003

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U18CET7002	IRRIGATION AND WATER RESOURCE MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Objectives

- To expose the students to different phases in Water Resources Management and National Water Policy
- To understand the components of various impounding structures
- Classify irrigation methods and summarize the irrigation management practices

Course Outcome

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

CO1: Apply knowledge of water resources to plan and assess data for project formulation in India and Tamil Nadu.

CO2: Apply water resource management techniques to solve issues related to flood and drought management.

CO3: Analyze irrigation engineering principles to distinguish between various methods of estimating crop water requirements and irrigation efficiencies.

CO4: Analyze the design of canal irrigation structures to interpret the forces acting on gravity dams and canal systems.

CO5: Apply irrigation methods to prepare an irrigation scheduling plan using surface, subsurface, and modern techniques like drip and sprinkler systems.

Pre-requisites:Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M		M		M					M	M	
CO2	M	M	M	M	S	M							M	M
CO3	M	S			M		M		M		M		M	
CO4	M	M		S								M	M	
CO5	M	M	S	M	S	M	M			M		M		M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

WATER RESOURCES **9 Hours**

Water resources of India and Tamil Nadu– Surface and Ground Water Resources - Concepts for Planning Water Resources Development-National water policy - Planning and Assessment of Data for Project Formulation

WATER RESOURCE MANAGEMENT **9 Hours**

Planning of Water storage reservoirs – Identification of location for reservoir - Types - principles of reservoir operation–Flood – Basics - Design flood estimation for various hydraulic structures – Flood management measures– Drought – concept – drought management measures – Application of Remote Sensing and GIS for water resource management – case studies

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IRRIGATION ENGINEERING **9 Hours**

Need – Merits and Demerits- Duty, Delta and Base period – Irrigation efficiencies – Crops and seasons- Crop water Requirement –consumptive and non-consumptive use – methods and Estimation of consumptive use of water.

CANAL IRRIGATION **9Hours**

Types of Impounding structures: Dams – Structure and classification of dams - Gravity dam – Forces acting on gravity dams , causes of failures – Diversion Head works- Canal drop and types of canal drop – Cross drainage works and Types – Canal lining – Types – Design procedure - Kennady's and Lacey's Regime theory.

IRRIGATION METHODS AND MANAGEMENT **9 Hours**

Direct and Storage methods of irrigation- Methods employed for application of water to irrigate fields by Surface and subsurface methods– Application of Drip and Sprinkler irrigation systems and their component parts- Irrigation scheduling and distribution - Participatory irrigation management- Organic farming –case study

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Punmia B.C, Pande Brij Basi Lal, Jain A.K "Irrigation and water power Engineering", Laxmi Publications, New Delhi 16th Edition, 2018.
2. Linsley R.K. and Franzini J.B,"Water Resources Engineering", McGraw-Hill Inc, 4th Edition 2013.
3. Garg S.K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, New Delhi, 23rd Revised Edition, 2017.
4. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 3rd Edition, 2008.
5. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1998.
6. Michael A.M., "Irrigation Theory and Practice", Vikas Publishing House Pvt. Ltd., Noida, 2nd Edition, 2008

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U18CEP7703	PROJECT PHASE-I	L	T	P	J	C
		0	0	0	6	3

Course Outcomes

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

CO1: prepare plan for various types of structures.

CO2: analyze and design various components of structures using software.

CO3: prepare the working and approval drawings for Civil engineering structures.

CO4: apply suitable software for the projects.

CO5: prepare the project reports in the prescribed formats.

CO6: present project proposals efficiently.

Pre-requisites: Nil

Course Assessment methods:

Direct	**Indirect**
1. Project report Oral presentation	Course end survey

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						S			S		M		S	
CO2		S	S		S	M			S		M	M	S	
CO3						S			S		M	M	S	
CO4					S	M			S		M	M	M	
CO5						M			S	S	M	M	S	
CO6						M			S	S	M	M	S	

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The design project involves the following:

1. Preparation of plan of a Civil engineering structure.
2. Analysis and design of the structure
3. Preparation of detailed drawings
4. Consolidated report preparation

Every Project Work shall have a Guide who is a member of the faculty of Civil Engineering of the college where the student is registered. The hours allotted for this course shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work and also to present in periodical seminars the progress made in the project.

Total : 60Hrs

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U18VEP7507	GLOBAL VALUES	L	T	P	J	C
		0	0	2	0	0

Course Outcomes

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

CO 1: Aware of the concept of Universal Brotherhood and support the organizations which are working for it

CO 2: Follow the path of Ahimsa in every aspect of their life

CO 3: Uphold the Universal declaration of Human Rights

CO 4: Understand the unequal distribution of wealth in the World and bestow their effort towards inclusive growth

CO 5: Sensitize the environmental degradation and work for the sustainable development

CO 6: Amalgamate harmony through Non-violence and edify the nation headed for upholding development

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES
4. U18VEP4504 / PROFESSIONAL VALUES
5. U18VEP5505 / SOCIAL VALUES
6. U18VEP6506 / GLOBAL VALUES

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							M					
CO2								S				
CO3									M			
CO4						S						
CO5											M	
CO6												S

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

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Values through Practical activities: **30 hours**

2. Universal Brotherhood : Meaning of Universal Brotherhood- Functioning of Various organization for Universal human beings -Red Cross, UN Office for Humanitarian Affairs – Case study on humanitarian problems and intervention - Active role of Students/Individual on Universal Brotherhood.

3. Global Peace, Harmony and Unity : Functions of UNO - Principal Organizations - Special organization – Case study relating to disturbance of world peace and role of UNO – Participatory role of Students/Individual in attaining the Global peace and Unity.

4. Non-Violence : Philosophy of nonviolence- Nonviolence practiced by Mahatma Gandhi – Global recognition for nonviolence - Forms of nonviolence - Case study on the success story of nonviolence– Practicing nonviolence in everyday life.

5. Humanity and Justice: Universal declaration of Human Rights - Broad classification - Relevant Constitutional Provisions– Judicial activism on human rights violation - Case study on Human rights violation– Adherence to human rights by Students/Individuals.

6. Inclusive growth and sustainable development : Goals to transform our World: No Poverty - Good Health - Education – Equality - Economic Growth - Reduced Inequality – Protection of environment – Case study on inequality and environmental degradation and remedial measures.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 hours**

REFERENCES

1. TEACHING ASIA-PACIFIC CORE VALUES OF PEACE AND HARMONY – UNICEF www.unicef.org/.../pdf/Teaching%20Asia-Pacific%20core%20values.pdf

2. THREE-DIMENSIONAL ACTION FOR WORLD PROSPERITY AND PEACE- IIM Indore - www.iimidr.ac.in/.../Three-Dimensional-Action-for-World-Prosperity-and-Peace-Glo...

3. MY NON-VIOLENCE - MAHATMA GANDHI www.mkgandhi.org/ebks/my_nonviolence.pdf

4. HUMAN RIGHTS AND THE CONSTITUTION OF INDIA 8th ... - India Juris www.indiajuris.com/uploads/.../pdf/l1410776927qHuman%20Rights%20080914.pdf

5. THE ETHICS OF SUSTAINABILITY – Research Gate www.researchgate.net/file.PostFileLoader.html?id...assetKey..

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SEMESTER-VIII

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U18CEP8701	Project Phase -II	L	T	P	J	C
		0	0	0	24	12

Course Outcomes

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

CO1: Carryout literature review of state-of-the-art works in civil engineering
CO2: Identify the real-world problems
CO3: Perform design and conduct relevant tests on various building materials as per BIS.
CO4: Apply advanced software techniques / skills.
CO5: Prepare the project reports in the prescribed formats.
CO6: Present project proposals and report effectively.

Pre-requisites: Nil

Course Assessment methods:

Direct	Indirect
1. Project report 2. Oral presentation	Course end survey

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							M					S	M	
CO2							S							M
CO3	M	M		S								M	S	
CO4	M	M			S							M		S
CO5	M	M							M	S			S	
CO6	M	M							S	S	M		S	

The surdents in a group of 3 to 4 Works on a topic approved by the Project Review committee of the department and prepare a comprehensive Project report after completing their Works to the satisfaction of the superviser. The Progress of the Project Works are evaluated based on three reviews conducted as per the time line given by the head of the institution.The Project Review committe may be constituted by the Head of the Department. A Project report to be submittted by the student's group (both hard copy and soft copy) at the end of the semester for its evaluation and department archives. The project work will be evaluated based on oral

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presentation and the content of the Project report jointly by external or internal examiners appointed by the Controller of Exams. Equal Weightage will be given for the internal three reviews (50 marks) and the final project work evaluation and oral presentation (50 marks)

REFERENCES

Anna university prescribed project report format for the respective academic year

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PROFESSIONAL ELECTIVES

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U18CEE0001 TRADITIONAL ARCHITECTURE

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To understand the historical evolution of Indian temple architecture.
- To integrate traditional principles with modern architectural needs and technologies.
- To explore the relationship between traditional engineering methods and contemporary architectural practices.
- To examine how architectural design varies across regions in India and its implications for modern practices.
- To learn advanced techniques in the preservation and restoration of traditional temple structures.

Course Outcome

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

CO1: To examine how architectural design varies across regions in India and its implications for modern practices

CO2: To learn advanced techniques in the preservation and restoration of traditional temple structures.

CO3: To learn about the regional traditions in India

CO4: To get an overview about the engineering aspects with traditional architecture

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							M							
CO2					M									M
CO3			M										M	M
CO4	M													
CO5								M				M	M	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

HISTORICAL DEVELOPMENT OF INDIAN TEMPLE ARCHITECTURE 9Hours

Evolution of temple architecture through different historical periods. Rig Vedic to Indus Valley Civilization- Mauryan, Sunga, Gupta, Satavahana, Rashtrakutas - Pandya, Chola, Pallava, Kakatiya, Hoysala, Vijayanagara, Nayak dynasties

BASIC CONCEPTS OF TRADITIONAL ARCHITECTURE 6 Hours

Fundamental principles of traditional Indian temple design. Mayamata, Vastu Shastra, Manasara

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Silpa Sastra (Saiva and Vaishnava), Agamas. New Additions: Integration of traditional design principles with modern architectural software and tools. Sustainable design practices derived from

REGIONAL TRADITIONS 10 Hours

Diverse architectural styles across different regions of India. Northern, Southern, Eastern, and Western India temple styles- Influences of external cultures and modern adaptations - Traditional buildings, temples, and sculptures- Case studies on the contemporary revival of regional temple architecture. Impact of climate and environmental factors on regional architectural styles.

ENGINEERING ASPECTS IN TRADITIONAL ARCHITECTURE

Traditional Engineering Techniques and materials. Structural elements, construction materials, construction techniques -Modern engineering solutions inspired by traditional practices. Advanced materials and technologies for structural reinforcement and restoration. Comparative study of traditional and modern construction methods.

PRESERVATION OF TRADITIONALBUILDINGS 12 Hours

Techniques for preserving and restoring traditional temple structures. General principles, techniques, materials for preservation- Preservation of arches, domes, vaults, pillars, beams, and arches. Latest conservation techniques and materials. Use of digital technology in documentation and preservation (e.g., 3D scanning, BIM) Legal and ethical considerations in the conservation of heritage structures.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

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U18CEE0002 PREFABRICATED STRUCTURES

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To gain knowledge about the prefabricated structures.
- To understand the types of joints and behavior of various precast elements.
- To know about the progressive collapse and its prevention.

Course Outcome

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

CO1: Understand the principles and need for prefabrication to explain its types, materials, and modular coordination.

CO2: Apply knowledge of prefabricated structural components to design and demonstrate their behavior under loads.

CO3: Analyze the design principles of prefabricated structures to solve problems related to joint flexibility and tolerances.

CO4: Distinguish various types of joints in structural members to interpret their detailing and functionality.

CO5: Evaluate the importance of progressive collapse prevention by comparing code provisions and guidelines.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M						M					M		
CO2	M		S										M	
CO3		S		M	M									
CO4			M						M					
CO5						S		M						M

Course Assessment methods:

4. Continuous Assessment Test I, II
5. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
6. End Semester Examination

INTRODUCTION 9 Hours

Need for prefabrication – Principles – Types of prefabrication - Disuniting of structures - Materials used – Modular coordination – Standardization – Systems – Production – Transportation – Erection – Elimination of erection stresses.

PREFABRICATED COMPONENTS 9 Hours

Behaviour of structural components – Large panel constructions –roof and floor slabs – Wall panels – Columns – Shear walls.

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DESIGN PRINCIPLES **9 Hours**

Form factor - Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation – Precision and dimensional Tolerance.

JOINTS IN STRUCTURAL MEMBERS **9 Hours**

Types of joints - Joints for different structural connections – Dimensions and detailing – Design of expansion joints.

PROGRESSIVE COLLAPSE & CODE PROVISIONS **9 Hours**

Progressive collapse – Code provisions – IS 15916:2010 – ASCE 7-02, ACI 318-02, GSA PBS Facilities Standards 2000, GSA PBS Facilities Standards 2003, GSA PBS Progressive collapse Guidelines 2003 - Importance of avoidance of progressive collapse.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Mokk, "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian, Academy of Sciences, Budapest, 2007.
2. Kim S. Elliott, "Precast Concrete Structures", British Library Cataloguing in publication Data, company, Woburn, 2002
3. Ramadevi K & Anuradha R., "Prefabricated Structures", VSRD Academic Publishing, Septmember, 2017.
4. Ramachandra Murthy S., "Design and Construction of Precast Concrete Structures", SKU DCPCS Category Book Publications, Chennai, 2017.
5. IS 15916:2010 – Building design and erection using prefabricated concrete – Code of practice.

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U18CEE0003	DESIGN OF REINFORCED CONCRETE STRUCTURES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

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

CO1: Apply the principles of reinforced concrete design to analyze and solve problems related to the design of cantilever and counterfort retaining walls.

CO2: Analyze the design considerations and structural behavior of rectangular, circular, and overhead water tanks as per IS 3370

CO3: Evaluate the yield line theory to determine the collapse load and plastic moment in different slab types, using the virtual work method.

CO4: Create a detailed design for single-span slab bridges and T-beam bridges.

CO5: Apply prestressing techniques in reinforced concrete structures.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	S	S	M			M	M				M	S	M
CO2	M	M	S	M			M	M				M	S	M
CO3	M		S	M	M		M	M				M	S	
CO4	M		S	M			M	M				M	S	M
CO5	M		S	M			M	M				M	S	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

RETAINING WALL — 9 Hours

Design of Cantilever and counterfort retaining wall

WATER TANK — 9 Hours

Design of rectangular and circular water tanks- resting on ground- below ground level- overhead water tank (As per IS 3370(Part I-III))

YIELD LINE THEORY — 9 Hours

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Assumptions – Characteristics of yield line – Determination of collapse load/ plastic moment – Application of virtual work method – square, rectangular, circular and triangular slabs – Design problems

BRIDGES AND FLAT SLAB **9 Hours**

Types of bridges – IRC loading – design of single span slab bridge, T-beam bridge. Flat slab – Types – design methods, IS code recommendations – Reinforcement details

INTRODUCTION TO PRESTRESS **9 Hours**

Introduction – Materials – IS Codes – Methods and systems of prestressing – Analysis for Stresses and Losses – Application

Theory:45	**Tutorial : 0**	**Practical :0**	**Total: 45Hours**

REFERENCES

1. Varghese, P.., " Advanced Reinforced Concrete Design", Prentice Hall of India, Pvt. Ltd., New Delhi, 2012.
2. Gambhir.M.L.," Design of Reinforced Concrete structures", Prentice Hall of India Private limited, New Delhi, 2012.
3. Subramanian, N. Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
4. Punmia, B.C., Ashok Kumar jain, Arun Kumar jain, " RCC Designs Reinforced Concrete Structures " , Laxmi Publications Pvt. Ltd., New Delhi, 2012.
5. I.C.Syal and A.K.Goel, "Reinforced Concrete Structures", S.Chand and Company Ltd, New Delhi, 2012.
6. Krishnaraju . " Prrstressed concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2016

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U18CEE0004 **ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS**

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To provide a basic understanding of the EIA process as its uses in research, planning, project or program evaluation, monitoring, and regulatory enforcement.
- To introduce legal, economic, social, administrative and technical process of preparing and/or evaluating environmental impact documents.
- To use the EIA tool for arriving practical situations in project planning and implementation and decision making

Course Outcome

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

CO1: Apply the concepts of Environmental Impact Assessment (EIA) process flow to create a clear process diagram for Civil Engineering projects.

CO2: Analyze various methods of EIA to assess their impact on the environment, including air, water, soil, and biological aspects.

CO3: Evaluate the socio-economic impacts of Civil Engineering projects by conducting a thorough Socio-Economic Impact Assessment (SIA).

CO4: Create a comprehensive EIA for Civil Engineering projects, incorporating screening, scoping, analysis, and mitigation measures.

CO5: Apply Life Cycle Assessment (LCA) as a decision-making tool in evaluating the sustainability and environmental impact of engineering projects.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S			S	S		S	M			S	S	S	M
CO2	S			S	S		S	M			S	S	S	M
CO3	S			S	S		S	M			S	S	S	M
CO4	S			S	S		S	M			S	S	S	M
CO5	S			S	S		S	M			S	S	S	M

Course Assessment methods:

4. Continuous Assessment Test I, II
5. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
6. End Semester Examination

INTRODUCTION AND HISTORICAL DEVELOPMENT OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA). **9 Hours**

EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA. EIA process- screening – scoping - setting – analysis – mitigation

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COMPONENTS AND METHODS FOR EIA **9 Hours**

EIA Matrices – Networks – Checklists – Connections and combinations of processes - Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment

SOCIO-ECONOMIC IMPACT ASSESSMENT **9 Hours**

Definition of social impact assessment-Social impact assessment planning process- measurement for SIA variables-Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Selecting, testing and understanding significant social impacts. Mitigation and enhancement in social assessment

ENVIRONMENTAL MANAGEMENT PLAN AND SECTORAL EIA **9 Hours**

Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment. EIA case studies related to the following sectors - Infrastructure –construction and housing Mining – Industrial - Thermal Power - River valley and Hydroelectric – coastal projects-Nuclear Power.

INTRODUCTION AND APPLICATION OF LCA **9 Hours**

Introduction and history of LCA terminology, Goal & scope definition Economic input-output (EIO) LCA Attributional versus consequential LCA. Future developments in LCA, Life cycle impact assessment (LCIA) Characterization factors, LCA-Case studies

Theory:45	**Tutorial : 0**	**Practical :0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. Environmental Impact Assessment(1st Edition-2017)Theory and Practice by Anji Reddy Mareddy ISBN: 9780128111390 eBook ISBN: 9780128112380 Imprint: Butterworth-Heinemann Published Date: 15th June 2017
2. Environmental Impact Assessment - 2012 by R.R. Barthwal (Author Publisher: New Age International Private Limited; 2 edition (1 January 2012)ISBN-10: 8122432271ISBN-13: 978-8122432275
3. Environmental Impact Assessment: A Guide to Best Professional Practices Hardcover – 2011 by Charles H. Eccleston (Author) Publisher: CRC Press; 1 edition (29 March 2011 ISBN-10: 1439828733 ISBN-13: 978-1439828731
4. Life Cycle Assessment(Theory and Practice)-2018 by Michael Z. Hauschild, Ralph K. Rosenbaum and Stig Irving Olsen Springer International Publishing AG 2018 (http://link.springer.com/openurl?genre=book&isbn=978-3-319-56475-3)
5. Canter, L.W., Environmental Impact Assessment and McGraw Hill, New York. 1996
6. EIA Online Learning Platform (www.iisd.org/learning/eia) International Institute for Sustainable Development –EIA Training Manual
7. http://www.MoEF.nic.in/division/EIA-Manual

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U18CEE0005

SURFACE WATER HYDROLOGY

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To Introduce the Concept of Hydrological Cycle and its Components / Parameters of the System
- To Impart the Concepts of Hydrograph
- To Learn the Impacts of Urbanization on Water Cycle

Course Outcome

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

CO1: Analyze historical precipitation data to quantify intensity, duration, and frequency, integrating statistical and mathematical tools.

CO2: Assess effective precipitation by estimating interception, depression storage, evaporation, and infiltration losses, utilizing scientific principles and field methods.

CO3: Develop and interpret flood and runoff hydrographs by applying hydrograph theory and Modeling techniques.

CO4: Design flood routing methodologies for watersheds by applying mathematical and simulation tools, considering environmental sustainability.

CO5: Evaluate urban water cycles and the impacts of urbanization on surface runoff using urban hydrology models and sustainability principles.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S			S								S	
CO2	S	S				M							S	
CO3		S	S	M							M		M	
CO4		S	S		S		S				M		M	
CO5		S					S					M		S

Course Assessment methods:

7. Continuous Assessment Test I, II
8. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
9. End Semester Examination

PRECIPITATION 9 Hours

Hydrologic cycle – Types of Precipitation – Forms of Precipitation – Measurement of Precipitation – Determination of Adequacy of Rain gauges – Check for consistency – Estimation of Mean Precipitation Over an Area – Maximum Intensity-Duration-Frequency Relationship – Probable Maximum Precipitation

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ABSTRACTIONS FROM PRECIPITATION **9 Hours**

Interception – Depression storage – Evaporation Process – Methods of Measurement – Infiltration – Measurement – Estimation of Infiltration indices.

HYDROGRAPHS **9 Hours**

Components of Hydrograph – Factors affecting Hydrograph – Base Flow Separation – Unit Hydrographs – Derivation of Unit Hydrographs – S-Curve – Synthetic Unit Hydrograph.

FLOODS AND FLOOD ROUTING **9 Hours**

Floods:

Causes of Flood – Factors Affecting Flood Flow – Methods of Estimation – Flood Control.

Peak discharge:

Flood Peak Estimation – Flood Frequency Studies – Gumbel's Method – Reservoir Routing – Channel Routing.

URBAN HYDROLOGY **9 Hours**

Introduction – Urbanised Landscape – Water Sustainability in Cities – Water Supply, Storm Water and Wastewater–Urban Water Cycle – Components of Water Budget –Methods of Computation – Urbanization Impact on Surface Runoff.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

16. VenTe Chow, David R. Maidment "Applied Hydrology," MCGRAW-HILL Professional, 2nd edition, 2013.
17. K. Subramanya – "Engineering hydrology," Tata McGraw-Hill, 4th Edition 2013.
18. H.M. Raghunath – "Hydrology," New Age International Publishers, 3rd Edition 2016.
19. K.N. Mutreja – "Applied Hydrology," Tata McGraw-Hill, 1986.
20. https://water.usgs.gov/watercensus/AdHocComm/Background/WaterBudgets-Foundations for Effective Water-Resources and Environmental Management.pdf

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U18CEE0006 AIR AND NOISE POLLUTION CONTROL

L	T	P	J	C
3	0	0	0	3

Course Objectives

At the end of this course the student should have learnt about various air pollutants in ambient and Indoor air and its sources and effect on building, vegetation and human health. Further able to calculate AQI index to denote the quality of ambient air. To Know about the standards for air quality and Noise quality and its preventive measures.

Course Outcome

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

CO1: Apply the knowledge of air pollutants, their sources,types, and to explain their effects on living and non-living beings.

CO2: Analyze the dispersion of pollutants in the atmosphere to measure their concentrations and predict environmental impacts.

CO3: Evaluate the sources and effects of indoor air pollution and design effective control measures for improving indoor air quality.

CO4: Analyze the principles involved in pollutant removal techniques to determine the best practices for effective air pollution control.

CO5: Create strategies for managing noise pollution by assessing its sources, impacts, and the effectiveness of control measures.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	S		S	S	S	S					M	S	M
CO2	M	S		S	S	S	S				M	M	S	M
CO3	M	S		S	S	S	S					M	S	M
CO4	M	S		S	S	S	S				M	M	S	M
CO5	M	S		S	S	S	S					M	S	M

Course Assessment methods:

10. Continuous Assessment Test I, II
11. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
12. End Semester Examination

INTRODUCTION 9 Hours

Definition of clean air, nature, air pollutants, sources of air pollutants, effects of air pollution on man, animal, vegetation and properties. Air Pollutants–Types of air pollutant - Stack Emission Standards – Ambient Air Quality Standards – Gaseous pollutant and its control measure. Air pollution control legislation and regulations -CPCB Guideline -Air Quality Indices. Air Quality Management in India. Disaster management and case study

METEOROLOGY AND AIR QUALITY MODELLING 9 Hours

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Geographical factors in air pollution - Meteorology factor -Sampling and Classification of sampling; sampling techniques; Monitoring ambient air pollution. – Pollution due to Automobiles – Analysis of Air Pollutants. - monitoring atmospheric pollution - Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants - Maximum mixing depth - Dispersion model - Gaussian plume derivation- modifications of Gaussian plume equation

CATALYTICCOMBUSTION AND INDOOR AIR POLLUTION **9 Hours**

Gaseous pollutant in ambient air -Principles of removal of a gaseous pollutant - Adsorption and combustion-catalytic combustion of organic materials-Catalytic oxidation and decomposition. Sources types and control of indoor air pollutants - Volatile Organic Compounds , Inorganic Gaseous Pollutants Respirable Particulates Bioaerosols, Radon and its decay products-Infectious disease transmission- sick building syndrome

AIR POLLUTION AND CONTROL MEASURES **10 Hours**

Control Equipment -Setting chambers; Momentum separators, Fibrous filters; Electrostatic precipitators; Bag houses, Centrifugal spray scrubbers; Venture scrubbers; Elementary principles of air pollution-control techniques. Sources types and control of indoor air pollutants - Volatile Organic Compounds , Inorganic Gaseous Pollutants Respirable Particulates Bioaerosols, Radon and its decay products-sick building syndrome

NOISE POLLUTION **8 Hours**

Sound and noise- Sources of noise pollution, Environmental and industrial noise pollution.- Effects of noise pollution- Prevention measures and Control of noise -Environmental and industrial noise-Noise pollution control legislation.

Theory: 45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

1. Anjaneyulu D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002.
2. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, 2017
3. Rao, C.S. Environmental Pollution Control Engineering, New Age International Publishers; 3rd Ed. 2018
4. Patrick C.F., ”Environmental noise pollution”, John Wiley & Sons,1977.
5. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, 2017
6. Rao, C.S. Environmental Pollution Control Engineering, New Age International Publishers; 3rd Ed. 2018
7. Khanna B K, “All You Wanted to Know About Disasters”, New India Publishing Agency, New Delhi, 2005.

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U18CEE0007 HOUSING PLANNING AND MANAGEMENT

L	T	P	J	C
3	0	0	0	3

Course Objectives

- The objective of the course is to train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects.
- The course focuses on cost effective construction materials and methods.
- Emphasis is given on the principles of sustainable housing policies and programmes

Course Outcome

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

CO1: Apply principles of sustainable housing to assess the objectives and strategies of national housing policies.

CO2: Analyze housing programs and slum housing projects to propose effective solutions using GIS and MIS tools.

CO3: Apply housing project layouts by integrating site analysis, building by-laws, and development control regulations

CO4: Analyze cost-effective construction techniques and materials to suggest green building solutions.

CO5: Apply housing finance models to study the viability and sustainability of public-private partnership projects.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S			M					W		S			S
CO2		M	M	M	M			W		S			M	
CO3						M	S			M	S	S		S
CO4		S			S			M			S		M	M
CO5	S		S			M	S		S			M		S

Course Assessment methods:

13. Continuous Assessment Test I, II
14. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
15. End Semester Examination

INTRODUCTION TO HOUSING 10 Hours

Definition of Basic Terms–House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing–Integrated approach on arriving holding capacity and density norms-All basic infrastructure consideration-Institutions for Housing at National, State and Local levels.

HOUSING PROGRAMMES 10 Hours

Basic Concepts, Contents and Standards for Housing Programmes-Sites and Services, Neighbourhoods-Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing

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Programmes –Slum improvement–Slum redevelopment and Relocation–Use of GIS and MIS in Slum Housing Projects, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing–Role of Non-Government Organizations in slum housing.

PLANNING AND DESIGN OF HOUSING PROJECTS **9 Hours**

Formulation of Housing Projects–Land Use and Soil suitability analysis-Building Byelaws and Rules and Development Control Regulations-RERA- Site Analysis, Layout Design, Design of Housing Units (Design Problems)–feasibility study- Housing Project Formulation.

CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS **8 Hours**

New Constructions Techniques–Cost Effective Modern Materials and methods of Construction-Green building concept-Building Centers–Concept, Functions and Performance Evaluation- optimum floor space index.

HOUSING FINANCE ANDPROJECT APPRAISAL **8 Hours**

Evaluation of Housing Projects for sustainable principles–Housing Finance, Cost Recovery–Cash Flow Analysis, Subsidy and Cross Subsidy-Public Private Partnership Projects–Viability Gap Funding-Pricing of Housing Units (Problems).

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Meera Mehta and Dinesh Mehta, “Metropolitan Housing Markets", Sage Publications Pvt Ltd., New Delhi, 2004.
2. Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House, Bombay, 2008.
3. Wiley-Blackwell,"Neufert Architects"Data,4th Edition, Blackwell Publishing Ltd, 2012
4. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design",8thEdition, Tata McGraw Hill Edition,2011
5. Walter Martin Hosack,"Land Development Calculations", McGraw Hill2ndEdition, USA2010
6. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.
7. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHSHabitat, Nairobi, 2010
8. Government of India, National Housing Policy,2007

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U18CEE0008 INTELLIGENT TRANSPORTATION SYSTEMS

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To learn the fundamentals of ITS.
- To study the ITS functional areas
- To have an overview of ITS implementation in global scenario

Course Outcomes

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

CO1 Analyze the components and architecture of Intelligent Transportation Systems
CO2 Evaluate data collection techniques used in ITS.
CO3 Apply telecommunications principles to ITS infrastructure.
CO4 Assess the functional areas and applications of ITS.
CO5 Create future-oriented solutions for traffic management and automation using ITS.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	S		M							M	W	W
CO2	W		S	M	M							M	S	W
CO3			S		S							M	M	W
CO4	M		S	M	S							M	M	W
CO5			S	S	S							S	M	M

Course Assessment methods

16. Continuous Assessment Test I, II
17. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
18. End Semester Examination

INTRODUCTION TO ITS 9 Hours

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Objectives, Historical aspects of ITS - System Working and Architecture, Components of ITS.

DATA COLLECTION TECHNIQUES 9 Hours

ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

TELECOMMUNICATIONS IN ITS 9 Hours

Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System;

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ITS FUNCTIONAL AREAS **9 Hours**

ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS)

TRAFFIC MANAGEMENT AND AUTOMATION **9 Hours**

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic toll collection, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management, Mobile Applications; Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries. Future of ITS.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45Hours

REFERENCES

7. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005
8. Gaetano Fusco, "Intelligent Transport Systems (ITS): Past, Present and Future Directions", Nova Science Publishers, 2017
9. Paolo Pagano, "Intelligent Transportation Systems-From Good Practices to Standards"CRC press 1st edition, 2016
10. https://www.pcb.its.dot.gov/eprimer/module1.aspx

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U18CEE0009 SUSTAINABLE CONSTRUCTION METHODS

L	T	P	J	C
3	0	0	0	3

Course Objectives

To study and understand the latest construction techniques of sub structure, super structure, special structures and various techniques involved in strengthening and demolition of structures. .

Course Outcomes

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

CO1: Apply trenchless and tunnelling technologies to demonstrate innovative substructure construction methods.

CO2: Analyze techniques of continuous concreting and formwork systems to interpret their application in tall structures.

CO3: Apply construction methods for special structures to propose suitable solutions for bridges and cooling towers

CO4: Analyze retrofitting and strengthening techniques to prioritize sustainable rehabilitation of structural elements.

CO5: Apply advanced demolition techniques to organize safe and efficient dismantling operations.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M	M			M	S			S	M	S	M	
CO2					M			M	M					S
CO3	S		M	M				S				S		M
CO4		S					S			S	M			S
CO5	M		W			S			W		S		S	

Course Assessment methods

19. Continuous Assessment Test I, II
20. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
21. End Semester Examination

SUB STRUCTURE CONSTRUCTION 9 Hours

Box jacking - Pipe jacking - trenchless technology, innovative road construction techniques, Tunnelling techniques, Smart tunnels: application and construction (Case study).

SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9 Hours

Vacuum dewatering of concrete flooring –concrete paving technology –techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections –launching techniques –suspended form work –erection techniques of tall structures, large span structures –launching techniques for heavy decks.

CONSTRUCTION OF SPECIAL STRUCTURES 9 Hours

Erection of lattice towers-Rigging of transmission line structures –Construction sequence in cooling towers, chimney, sky scrapers -Bow string bridges, Cable stayed bridges –Construction of jetties and break water structures –Construction sequence and methods in domes.

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REHABILITATION AND STRENGTHENING TECHNIQUES **9 Hours**

Seismic retrofitting-Strengthening of beams -Strengthening of columns -Strengthening of slab -Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – underpinning for strengthening floor and shallow profile - Sub grade water proofing.

DEMOLITION **9 Hours**

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

11. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
12. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
13. Peter.H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.Press, 2011.
14. Robertwade Brown,Practical foundation engineering hand book, McGraw Hill Publications, 1995.
15. Roy Chudley and Roger Greeno., "Advanced Construction Technology", Pearson Education (US), 2005.
16. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University., New Delhi, 2008.

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U18CEE0010 PRETRESSED CONCRETE STRUCTURES

L	T	P	J	C
3	0	0	0	3

Course Objectives

The Objective of this course is to make the students to learn the following topics:

- Prestressing concepts in concrete
- Design of prestressed concrete members in flexure, shear and torsion
- Design of compression members, tension members and composite structures and various concepts involved in design of prestressed concrete elements

Course Outcome

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

CO1 : Apply the principles of prestressing to analyze flexural strength and assess the effects of prestress losses.

CO2 : Evaluate limit state concepts to design prestressed beams ensuring collapse and serviceability criteria.

CO3 : Analyze shear, torsion, and anchorage zone stresses to design safe and efficient prestressed concrete elements.

CO4 : Develop strategies for analyzing statically indeterminate prestressed structures using cable profiles and deflection control.

CO5 : Design specialized prestressed structures such as pipes, tanks, and compression members for professional applications

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M	S	M									M	
CO2	S		S	M			M						M	
CO3	S		S	M	M							S	S	
CO4	S	M	S	M									M	M
CO5	S		S	M			M							M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

PRINCIPLES AND ANALYSIS FOR FLEXURE 9 Hours

Principles of prestressing- Types of prestressing systems- Materials-Systems and devices – Analysis and design for flexure- General concepts of prestress- losses in prestress- Analysis for ultimate strength.

DESIGN FOR FLEXURE 9 Hours

Concept of Limit State design- Limit state of Collapse and serviceability – Analysis of ultimate

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strength.

DESIGN FOR SHEAR TORSION AND ANCHORAGE ZONE 9 Hours

Design for shear in rectangular beams- Modes of failure – design for Torsion, shear and bending. Anchorage zone – analysis and design of pre-tensioned and post tensioned end blocks

STATICALLY INDETERMINATE STRUCTURES 9 Hours

Analysis of continuous beams- linear transformations- concept of concordance- choice of cable profiles- deflection of prestressed members.

SPECIAL STRUCTURES 9 Hours

Concept of circular prestressing- design of prestressed concrete pipes and cylindrical water tanks- composite constructions- types, behaviour, flexural stresses, compression members – design of poles, piles and sleepers. Design for Tension.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. N.Krishnaraju, "Prestressed Concrete", tata McGraw-Hill Publishing Company, 4th Ed, 2012
2. N.C.Sinha & S.K.Roy, "Fundamentals of Prestressed Concrete", s.Chand &Co, new delhi,2011
3. N.rajagopalan, "Prestressed Concrete", Norosa Publishing House, 2014.
4. T.Y.Lin& Ned Bhurns, "Design of Prestressed Concrete Structures", 3rd edition, John Wiley & Sons, 1982.

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U18CEE0011 PRE-ENGINEERED BUILDINGS

L	T	P	J	C
3	0	0	0	3

Course Objectives

To study

- importance of prefabricated and precast structures as applied to concrete, RCC and structural steel.
- Importance of standardization, modular construction, tolerances as per national building code of practice.
- Various prefabricates and their design philosophy as applied to tension, compression, shear and flexural elements.
- Various construction techniques and equipments for transportation of precast elements.

Course Outcome

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

CO1: identify suitable precast module and system for structural elements based on the requirements of national building code.

CO2: classify and design different prefabricated systems subjected to various forces.

CO3: apply different construction techniques for operating various elements such as panels, slabs and plates.

CO4: use proper equipments for horizontal and vertical transportation of pre-cast elements.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M				S						S	M	M	
CO2		S				M				S		M	M	
CO3		S				S				M		M	S	
CO4	S				M						M	M	M	
CO5	M				S						S	M		

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

INTRODUCTON **6 Hours**

Prefabricated construction, necessity, advantages, disadvantages, Mass produced steel, Industrialized buildings.

PLANNING AND SPECIFICATONS **9 Hours**

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Modular coordination, basic module, planning and design modules, modular grid systems, National Building Code Specifications, standardization, dimensioning of products, preferred dimensions and sizes, tolerances and deviations, layout and process.

STRUCTURAL CLASSIFICATIONS **9 Hours**

Prefabricates classification, foundation, columns, beams, roof and floor panels, wall panels, box prefabricates, erection and assembly.

DESIGN OF ELEMENTS **9 Hours**

Design of prefabricated elements, Lift points beams, slabs, columns, wall panels, footings, design of joints to transfer axial forces, moments and shear forces.

LAUNCHING TECHNIQUES **7 Hours**

Construction techniques, large panel construction, lift slab system, Glover system, Constains's Jack - block system, Constain V-plate system, Bison system, Silber –Kuhi system, control of construction processes

EQUIPMENTS FOR TRANSPORTATON **5 Hours**

Equipments for horizontal and vertical transportation.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. K. S. Vivek und P. Vyshnavi, (2017)) Pre - Engineered Steel Building, Limit State Design of Structural Members, LAP LAMBERT Academic Publishing
2. Alexander Newman, (2014) Metal Building Systems, Design and Specifications, Third Edition, McGraw-Hill Education
3. Hass, A.M. (1983), Precast Concrete, Design and Applications, Taylor & Francis, UK.
4. Phillips, W.R. and Sheppard, D.A. (1980), Plant cast, Precast and Prestressed Concrete, McGraw Hill, New York.

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U18CEE0012 EARTHQUAKE ENGINEERING

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To gain knowledge about the types of vibration and damping.
- To understand dynamic response of SDOF and MDOF systems.
- To design and introduce ductility into RC structural elements as per code provisions.
- To study active and passive vibration control devices.

Course Outcome

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

CO1: Apply the basics of engineering seismology and theory of vibration for earthquake analysis.

CO2: Analyze the response of single degree of freedom (SDOF) systems to various types of excitation.

CO3: Analyze the behavior of multiple degree of freedom (MDOF) systems using normal modes of vibration

CO4: Analyze the code provisions for seismic design of structural elements as per relevant IS codes and apply principals of active and passive control devices for mitigating earthquake effects.

CO5: Apply IS code provisions and Design structural elements

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	W	M	W	W	W								W	
CO2	S	S	W	W	M								M	
CO3	S	S	W	W	M								M	
CO4	S	S	W	W	W	W	M	W				S	M	M
CO5	M	W	S	W	M	W		W				S	M	M

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

INTRODUCTION **6 Hours**

Engineering Seismology, Theory of vibration, Importance of Vibration Analysis Indian Seismicity, Earthquake history.

SINGLE DEGREE OF FREEDOM (SDOF) SYSTEMS **9 Hours**

Degrees of freedom – SDOF idealization - Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral.

MULTIPLE DEGREE OF FREEDOM (MDOF) SYSTEMS **9 Hours**

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Two degree of freedom system – Normal modes of vibration, Natural frequencies and Mode shapes, Introduction to MDOF system, Decoupling of equations of motion – Concept of mode superposition.

BIS SPECIFICATIONS AND SPECIAL TOPICS **9 Hours**

Code Provisions of Design of Buildings as per IS1893 and IS4326, Ductile Detailing of Structures as per IS13920, Behaviour and Design of Masonry Structures as Per IS 13827 and IS13828. Active and passive control devices, Soil liquefaction.

DESIGN OF STRUCTURAL ELEMENTS **12 Hours**

Design of RC beams, columns and shear walls Concrete as per IS code provisions.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. S.K.Duggal, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, 2015.
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, 2016.
3. Duggal S.K., Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, 2013.
4. Neville, A.M, Properties of Concrete, Pitman Publishing Limited, London, 1995.
5. Damodarasamy and Kavitha, Basics of Dynamics and Aseismic Design, PHI Learning Pvt Ltd., 2009.

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U18CEE0013 **INDUSTRIAL WASTEWATER TREATMENT**

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To understand the industrial process, water utilization and wastewater generation
- To impart knowledge on selection of treatment methods for industrial wastewater
- To acquire the knowledge on operational problems of common effluent treatment plants
- To gain knowledge on different techniques and approaches for minimizing the generation and reuse, recovery and disposal of industrial effluent
- To have awareness of the health, occupational and safety rules and regulations

Course Outcome

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

CO1: Understand the concepts of industrial wastewater characteristics, pollution effects, and legislative measures to assess the impact of effluents on various ecosystems.

CO2: Explore the various waste management approaches in industrial processes, focusing on waste audits and recycling strategies for cleaner production.

CO3: Conduct waste audits and assess various wastewater treatment technologies used in industries

CO4: Understand the integrated treatment systems by applying physico-chemical and biological methods to combine municipal and industrial waste management effectively

CO5: Design and select appropriate treatment technologies for treating industrial effluent

CO6: Develop and adopt the importance of industrial health and safety measures by analyzing occupational health hazards and proposing control strategies based on toxicity levels.

Pre-requisites:Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S				S	S						S	
CO2		S				S	M							S
CO3	S		S		S		S						S	
CO4		S					S	M					S	
CO5			S		S	S							S	
CO6						S		S			M			S

Course Assessment methods:

22. Continuous Assessment Test I, II
23. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
24. End Semester Examination

INTRODUCTION **7 Hours**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

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CLEANER PRODUCTION **8 Hours**

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

POLLUTION FROM MAJOR INDUSTRIES **10 Hours**

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

TREATMENTTECHNOLOGIES **12 Hours**

Equalisation – Neutralisation – Physico chemical treatment: Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue & sludge management – Dewatering – Disposal

INDUSTRIAL HEALTH AND SAFETY MANAGEMENT **8 Hours**

Importance of Industrial safety - Occupational Health Hazards, Classification of health hazards and their effects. Promoting safety and health training, biochemical action of toxic substance and toxicity, type and degrees of toxic effects, threshold limits of exposure (TLV), STEL, IDLH, Ld/LC etc – Occupational and Environmental safety measures in area specific industries

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Nemerow, Nelson Leonard., 2007. "Industrial waste Treatment", Elsevier Science & Technology.
2. Ahmad Ashfaq., 2014. Industrial waste treatment technology", S.K. Kataria &Sons.
3. M.N.Rao & A.K.Dutta, 1995. "Wastewater Treatment", Oxford - IBH Publication.
4. W.W. Eckenfelder Jr., 2000. "Industrial Water Pollution Control", 2000. 3rd ed. McGraw-Hill Book Company, New Delhi.
5. R.L.Stephenson and J.B.Blackburn, Jr., 1998. "Industrial Wastewater Systems Hand book", Lewis Publisher, New Yark.
6. H.M.Freeman, 1995. "Industrial Pollution Prevention Hand Book", McGraw-Hill Inc., New Delhi.
7. Charles D.Reese, 2017. "Occupational Health and Safety Management: A Practical Approach", 3rd ed. CRC press, Taylor & Francis ltd.
8. Deshmukh, and L M., 2005. "Industrial safety management", McGraw Hill publication.

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U18CEE0014 **CLIMATE CHANGE AND SUSTAINABLE MANAGEMENT**

L	T	P	J	C
3	0	0	0	3

Course Objectives

- Understand the earth climate system and drivers responsible for changes in the climate system
- Recognize the causes and effects of climate change at the atmospheric and earth levels
- Identify the potential impacts and vulnerability due to climate change onvarious sectors and regions
- Adopt sustainable management practices to protect the future earth climate system

Course Outcome

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

CO1: Elucidate the climate system and the drivers of climate change and apply this understanding to explain the impacts on Earth's environment.

CO2: Categorize the causes of climate change and analyze their observed effects on global ecosystems and local environments.

CO3: Understand climate risk and evaluate different climate prediction techniques to assess future climate trends.

CO4: Exemplify sustainable management practices by analyzing government policies and proposing effective measures to mitigate climate change.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M	M	M	M	W	M			S	S	M	M	S
CO2	S	M	S	M	W	W	M			M	M	S	M	S
CO3	S	M	M	M	M	M	M			M	M	M	M	S
CO4	S	M	S	M	M	M	S			M	M	S	M	S

Course Assessment methods:

25. Continuous Assessment Test I, II
26. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
27. End Semester Examination

ATMOSPHERE AND EARTH'S CLIMATE SYSTEM **9 Hours**

Atmospheric structure and composition, Radiative processes in the atmosphere- Earth Climate System – Drivers of Climate System - Components -– Role of components on Climate system - Hydrological cycle, Carbon Cycle–Earth's Carbon reservoirs - Global Wind Systems - Cloud Formation - Types - Monsoon Rains - Global Ocean Circulation – El Nino and Southern Oscillation

CAUSES OF CLIMATE CHANGE AND THE OBSERVED VARIABILITY **9 Hours**

Brief History of past earth's climate - Koppen Climate Classification –Weather and Climate -Causes of Change in climate - The Green House Effect – Earth's Natural and Anthropogenic Climate change – Observed Effects of the climate change – Global Warming – Changes in patterns of precipitation - Floods and Drought – Storms and Hurricanes - Sea level rise – Climate Sensitivity and Feedback

IMPACTS, VULNERABILITY AND ADAPTATION **9 Hours**

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Evidences of Changes in Climate and Environment – on a Global Scale and in India - Impacts and vulnerability of Climate Change on various sectors – Agriculture, Forestry, Coastal Ecosystem – Water Resources – Human Health - Society - Incorporated Adaptation measures

PREDICTION OF CLIMATE CHANGE **9 Hours**

Forecasts – short term, medium range and long range prediction–Tools for Climate prediction - Modelling –Current climate models- climate model evaluation using performance indicators

APPROACH TO A SUSTAINABLE MANAGEMENT **9 Hours**

Sustainable Development - Scope and Emerging Trends- Concept of sustainability - Tools and ways to achieve sustainability - Measure and monitor the progress- Policies and programmes - Sustainable Development Goals (SDG) - Climate and Sustainable Development - An Interface - UNFCCC – IPCC –India's National Mission – A way forward to mitigate climate change -Case studies

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

21. Juha I. Uitto, Jyotsna Puri Rob D. van den Berg, "Evaluating Climate Change Action for Sustainable Development", Springer, 2017.
22. Dow, Kirstin Downing, Thomas Emote atlas of climate change: mapping the world's greatest challenge "Berkeley: University of California Press, 2011.
23. Dash Sushil Kumar, Climate Change – An Indian Perspective, Cambridge University Press India Pvt. Ltd, 2007
24. Climate Change 2007 – The Physical Science Basis, IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, 2007
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26. K. McGuffie and A. Henderson-Sellers, "A Climate Modelling Primer", 3rd Edition, John-Wiley, New York, 2004.
27. https://in.one.un.org/wp-content/uploads/2018/10/English_MP_UNDP_SDG_Booklet_ 25Jan18.pdf
28. India and Sustainable Development Goals: The Way Forward, Research and Information System for Developing countries, New Delhi, 2016.

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U18CEE0015 **WASTE MANAGEMENT**

L	T	P	J	C
3	0	0	0	3

Course Objectives

At the end of this course the student should able to know how to manage solid and hazardous waste from its inception to disposal. They have learnt about various technologies that convert non-recyclable waste into usable form of energy. To know about E-Waste management and its ill-effects on health and society

Course Outcome

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

CO1: Analyze waste management challenges by applying integrated waste management principles and sustainability practices.

CO2: Develop and implement resource recovery strategies and safe treatment methods for municipal and industrial waste.

CO3: Apply knowledge of hazardous and biomedical waste management techniques to ensure safe handling, storage, and disposal.

CO4: Evaluate the potential for energy generation from diverse waste streams using thermal, biochemical, and mechanical processes.

CO5: Design innovative and sustainable methods for e-waste management, focusing on recovery, recycling, and stakeholder collaboration.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S				M	S		M			M		
CO2	S	S	S		M	M	S		M			M	M	
CO 3	S	S	M	M		S	M	S				M	M	
CO 4	S	S		S	S		S					S	S	M
CO5		S	M		S	S	S	M		M		S	M	M

Course Assessment methods

28. Continuous Assessment Test I, II
29. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
30. End Semester Examination

INTRODUCTION **9 Hours**

Principles of waste management. – Waste minimization. – Integrated waste management. – Waste management and environmental protection. – Waste management concept. Best management practices for sustainable development. – Information systems in waste management – Legal Aspects of Environmental Management. Environmental Legislations in India – Swachh Bharat Mission and Smart Cities Program - MoEF Guideline.

9 Hours

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SOLID WASTE MANGEMENT

Introduction to Solid Waste Management – Municipal Solid Waste Characteristics and Quantities MSW Rules 2016 – Municipal Solid Waste Collection – Transportation – Segregation and Processing Disposal of Municipal Solid Waste Biochemical Processes and Composting. Current Issues in Solid Waste Management – Disposal of Solid Waste-Municipal solid waste in Indian conditions, legal aspects of solid waste disposal, Plastic waste – Plastic waste disposal.

HAZERDEOUS WASTE AND BIOMEDICAL WASTE MANAGEMENT **9 Hours**

Hazardous waste definition – Physical and Health hazards wastes – Hazardous Waste Management and Handling Rules – Characterization of hazardous wastes Source reduction of hazardous wastes. Handling and storage of Hazardous wastes –Waste Compatability Chart – Hazardous Waste Transport- Manifest system – Transboundary movement of wastes – Basal Convention – Hazardous waste treatment technologies – Physical, chemical and thermal treatment of hazardous waste – Solidification – Chemical fixation – Encapsulation – Incineration. Secured landfills

ELECTRONIC WASTE **9 Hours**

Present scenario of E-Waste management in India- Composition of E-Waste and its generation rates .Effect of E-waste on human health, environment and society. Role of various stakeholders in E-waste management .Recover and recycling of Electronic Waste .Extraction of Rare-Earth Minerals. Rules and Legislation .Formal Metal extraction processes from E-Waste; Life-Cycle-Analysis (LCA) The challenges of E-Waste management for smart cities.

ENERGY FROM WASTE **9 Hours**

Characterization of wastes - Energy production form wastes through incineration, energy production through gasification of wastes - Energy production through pyrolysis and gasification of wastes, syngas utilization. - Densifications of solids, efficiency improvement of power plant and energy production from waste plastics. Week Energyproduction from waste plastics, gas cleanup- Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells - Cultivation of algal biomass from wastewater and energy production from algae.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

RFERENCES

1. Hazardous waste (management and handling) rules, 2001
2. Ramachandra T.V., Management of Municipal Solid Waste, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore. 2006.
3. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
4. Hazardous waste management Charles A. Wentz. Second edition McGraw Hill International.1995
5. Efstratios N Kalogirou Waste to Energy technology and Global application,CRC Press 2017.

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U18CEE0016 BUILDING INFORMATION MANAGEMENT

L	T	P	J	C
3	0	0	0	3

Course Objectives

- To understand strategies and aspects of building service requirements and the constraints involved in it.
- To plan buildings with proper interface integration

Course Outcome

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

CO1: Apply principles of structural systems to demonstrate effective materials selection and enclosure systems.

CO2: Analyze environmental aspects and building services to prioritize interior environmental quality.

CO3: Apply system integration techniques to organize the interaction of structural, mechanical, and electrical systems.

CO4: Analyze construction components of infrastructure projects to interpret their relevance to modern needs.

CO5: Apply maintenance planning techniques to prepare fire-safe and pollution-free construction systems.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes(Pos)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M		M			S		M		S			M	S
CO2			M	M	S		S		S		S			M
CO3	S	S			S		W							S
CO4		S	M	W		S			S		S	S	S	
CO5	S						M			S				S

Course Assessment methods

31. Continuous Assessment Test I, II
32. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
33. End Semester Examination

STRUCTURAL SYSTEM **9 Hours**

Systems for enclosing Buildings, Functional aesthetic system, materials selection and specification.

ENVIRONMENTAL ASPECTS AND SERVICES **9 Hours**

Qualities of enclosure necessary to maintain a specified level of interior environmental quality – Weather resistance – Thermal infiltration – Acoustic Control –Transmission reduction – Air quality – Illumination.

SYSTEM INTEGRATION **9 Hours**

Systems integration with structural systems, Mechanical, Plumbing – Electricity –Vertical circulation and their interaction-Technological demands on construction management in infrastructure development projects.

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CONSTRUCTION AND INFRASTRUCTURE **9 Hours**

Construction component of various infrastructure projects, highway, railway, airports, harbour, power transmission lines -. Prospects of infrastructure sector, current scenario and future needs.

MAINTENANCE AND SAFETY **9 Hours**

Planning systems for least maintenance materials and construction – Access for maintenance – Feasibility for replacement of damaged components – Maintenance free exposed and finished surfaces, ability of systems to protect fire – preventive systems – fire escape system design – planning for pollution free construction- environmental constraints – Hazard free Construction execution.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

RFERENCES

6. E.C. Butcher and A.C. Parnell, Designing for Fire Safety, John Wiley and Sons, 1993.
7. William T. Mayer, Energy Economics and Build Design, McGraw-Hill Book Company, 1983.
8. Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd. London.

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U18CEE0017 MASS TRANSIT MANAGEMENT

L	T	P	J	C
3	0	0	0	3

Course Objectives

This course discusses management methods of relevance to public transportation systems. Makes to understand strategic planning management, labor relations, maintenance planning and administration, and fare policy, and management information and decision support systems. The course explains the smart facilities and systems.

Course Outcomes

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

CO1: Understand the basic elements in mass transit modes.
CO2: Acquire the basic knowledge about strategic planning of networks
CO3: Understand the concepts of transit and crew scheduling.
CO4: Understand the organisational structure and performance measures.
CO5: Acquire the know-how of smart facilities and system in transit management.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S					M					M	M	S	M
CO2				M		M					M	M	S	M
CO3	S			M		S					M	M	S	M
CO4				M		S					M	M	S	M
CO5	S			M	M	S					M	S	S	M

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

MASS TRANSIT MODES **9 Hours**

Introduction, modes of public transport and comparison, public transport travel characteristics, trip chaining, technology of bus, rail, rapid transit systems, basic operating elements

STRATEGIC MANAGEMENT AND PLANNING **9 Hours**

Planning Objectives, principles, considerations, transit lines – types, geometry and characteristics, transit routes and their characteristics, timed transfer networks, prediction of transit usage, evaluation of network, accessibility considerations;

TRANSIT SCHEDULING **9 Hours**

Components of scheduling process, determination of service requirements, scheduling procedure, marginal ridership, crew scheduling

TRANSIT AGENCY AND ECONOMICS **9 Hours**

Organizational structure of transit agency, management and personnel, transit system statistics, performance and economic measures, operations, fare structure

SMART TRANSIT FACILITIES **9 Hours**

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Bus stops and terminals – principles of good layout, types of layout, depot location, twin depot concept, crew facilities and amenities. Fleet maintenance – safety and security – Information system – Intelligent Transport system – Case studies.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45Hours

REFERENCES

17. Ashish Verma and T.V. Ramanayya, Public Transport Planning and Management in Developing Countries, CRC Press Taylor and Francis group, 2014.
18. D. Johnson Victor and S. Ponnuswamy, Urban Transportation: Planning, Operation and Management, Tata McGraw hill, 2012.
19. Vukan, R. Vuchic, Urban Transit Systems and Technology, John –Wiley & Sons, NewJersey, 2007.
20. John Duke, Fleet Management, McGraw-Hill Co, USA, reprint 2012
21. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-259j-transit-management-fall-2006

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U18CEE0018	RAILWAYS, AIRPORTS, DOCKS AND HARBOUR ENGINEERING	L	T	P	J	C
		3	0	0	0	3

Course Objectives

- To understand the basics and design of various components of railway engineering.
- To learn about the aircraft characteristics, planning and components of airport.
- To study about the types and components of docks and harbour.

Course Outcomes

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

CO1 Apply principles of railway planning and construction.
CO2 Analyze railway construction and maintenance techniques.
CO3 Evaluate airport planning principles.
CO4 Apply airport design concepts.
CO5 Apply harbor design concepts considering environmental factors.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S		S	M					M	M	S
CO2	S	S	S	S		S	M					M	M	S
CO3	M			S		S	M					M	M	S
CO4	S	S	S	S		S	M					M	M	S
CO5	M			S		S	M					M	M	M

Course Assessment methods

34. Continuous Assessment Test I, II
35. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
36. End Semester Examination

RAILWAY PLANNING AND CONSTRUCTION 9 Hours

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods–Geometric design of railway, gradient, super elevation, widening of gauge on curves-points and crossings.

RAILWAY CONSTRUCTION AND MAINTENANCE 9 Hours

Earthwork – Stabilization of track on poor soil – Track drainage – Calculation of Materials required for track laying – Construction and maintenance of tracks – Railway Station and yards and passenger amenities-Signalling- Urban rail- MRTS-Metro-mono rail.

AIRPORT PLANNING 9 Hours

Air transport characteristics – airport classification – ICAO – airport planning: Site selection typical Airport Layouts, parking and Circulation Area

AIRPORT DESIGN 9 Hours

Runway Design: Orientation, Wind Rose Diagram – Runway length – Problems on basic and Actual length, Geometric design of Runways, Configuration and Pavement Design Principles

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– Elements of taxiway Design – Airport zones – Passenger Facilities and Services – Runway and Taxiway Markings and lighting

HARBOUR ENGINEERNG **9 Hours**

Definition of Basic terms : Harbour, Port, Satellite port, Docks, Waves and Tides – Planning and design of Harbours : Requirements, Classification, Location and design principles – harbour layout and terminal facilities- Coastal structures : Piers, Breakwaters, Wharves, jetties, Quays, Spring fenders, Dolphins and Floating Landing Stage- Environmental concern of Port operations – Coastal Regulation Zone, 2011.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. SaxenaSubhash C and Satyapal arora, "A course in Railway Engineering", Dhanpat rai and Sons, Delhi, 2010.
2. Satish Chandra and Agarwal M.M. "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi, 2013.
3. Khanna S.K., Arora M.G and Jian S.S "Airport Planning and Design" Nemchand& Brothers, Roorkee, 2012.
4. Bindra S.P, "A Course in Docks and Harbour Engineering" Dhanpat rai and Sons, New Delhi, 2013

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U18CEE0019 **SUSTAINABLE INFRASTRUCTURE DEVELOPMENT**

L	T	P	J	C
3	0	0	0	3

Course Objectives

To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

Course Outcomes

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

CO1: Understand the environment sustainability goals at global and Indian scenario.

CO2: Understand risks in development of projects and suggest mitigation measures.

CO3: Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.

CO4: Explain Life Cycle Analysis and life cycle cost of construction materials.

CO5: Explain the new technologies for maintenance of infrastructure projects.

Pre-requisites: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				M			S		S	M		M		S
CO2				M			S		S	M		M		S
CO3				M			S		S	M		M		S
CO4				M			S		S	M		M		S
CO5				M			S		S	M		M		S

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

SUSTAINABLE DEVELOPMENT GOALS **9 Hours**

Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands – Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian – Infrastructure Project finance – Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.

SUSTAINABLE INFRASTRUCTURE PLANNING **9 Hours**

Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment (EIA), Land acquisition -Legal aspects, Resettlement &Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on 360

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Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling)

SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES **9 Hours**

Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics - Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures – Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings.

SUSTAINABLE CONSTRUCTION MATERIALS **9 Hours**

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme - Environmental product declarations – Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies

SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS **9 Hours**

Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance .

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.
5. New Building Materials and Construction World magazine
6. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher:Belhaven Press,ISBN:1852930039.
7. Munier N, "Introduction to Sustainability", Springer2005 361

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8. Sharma, “Sustainable Smart Cities In India: Challenges And Future Perspectives”, SPRINGER, 2022.
9. Ralph Horne, Tim Grant, KarliVerghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing,2009 1
10. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union;2010
11. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).

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U18CEE0020	OCCUPATION HEALTH, SAFETY AND WELL BEING	L	T	P	J	C
		3	0	0	0	3

Course Objectives

This course Occupational Health and Safety management principles, risk assessment, severity rating and risk probability. accident causation and associated hazards, and consequently Priorities mitigation measure w.r.t. work-place ergonomics.

Course Outcomes

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

CO1:Compare Occupational Health and Safety management principles for safety and sustainability.
CO2:Analyse principles of OHS while testing for exposure limits, risk assessment, severity rating and risk probability.
CO3:Evaluate accident causation and associated hazards, and consequently Prioritise mitigation measure w.r.t. work-place ergonomics.
CO4:Formulate Occupational Health and Safety Considerations and Policies for Work places.
CO5:Identify latest techniques and developments in Occupational Health and Safety engineering.

Pre-requisites: Nil

S

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S		S	S	S		S		M		S	M	S
CO2	S	S		S	S	S		S		M		S	M	S
CO3	S	S		S	S	S		S		M		S	M	S
CO4	S	S		S	S	S		S		M		S	M	S
CO5	S	S		S	S	S		S		M		S	M	S

Course Assessment methods

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

Occupational Hazard and Control Principles **9 Hours**

Relevance of OHS in Global Industrial Scenario and impacts on Economy. Job opportunities as Safety Engineers. OSHA Limitations and the Need for Change. Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation. Program Workers' Compensation - Unsafe Acts vs. Unsafe Conditions.

Ergonomics at Workplace **9 Hours**

Ergonomics Task analysis, Preventing Ergonomic Hazards, Workspace. Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations. Indoor Air Quality: Asbestos Awareness - Blood-borne Pathogen

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Fire Prevention and Protection **9 Hours**

Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.

Electrical Safety: Standard and Lockout/Tagout - Product Safety: Technical Requirements of Product safety - Process Safety Management. Exit Routes, Emergency Action Plans and Confined Spaces & Entry

Health Considerations at Workplace **9 Hours**

Types of diseases and their spread, Health Emergency. Principles of Personal Protective Equipment/Clothing, types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability**.** Forklift Safety/Heat Stress/Ladder Safety /Scaffold Safety**.**

Principles of Industrial Hygiene: **9 Hours**

Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors. OSHA Record Keeping

Design based Problems (DP)/Open Ended Problem: Analysis of Compliance wrt OHS at different Industries/work places

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. Goetsch D.L, "Occupational Safety and Health for Technologists", Engineers and Managers
2. Prentice Hall, 1999.
3. Heinrich H.W, "Industrial Accident Prevention-A Scientific Approach", McGraw-Hill Book Company, 2007.
4. Colling D.A., "Industrial Safety Management and Technology", Prentice Hall, 1990.
5. Della D.E. and Giustina Van Nostrand Reinhold, "Safety and Environmental Management", 1st Edition 1996.

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U18CEE0021	GROUND IMPROVEMENT TECHNIQUES	L	T	P	J	C
		3	0	0	0	3

Course Objectives:

1. To introduce the essential ground improvement methods used in foundation engineering.
2. To provide insights into drainage, dewatering, and seepage control techniques in soil stabilization.
3. To impart knowledge on in-situ soil treatment techniques for densification and consolidation of different soil types.

Course Outcomes:

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

CO1: Apply various methods of ground improvement to solve geotechnical problems in different soil conditions.

CO2: Analyze drainage and dewatering techniques to interpret solutions for seepage-related issues.

CO3: Distinguish between in-situ treatment methods for densification and consolidation in cohesionless and cohesive soils.

CO4: Evaluate the use of earth reinforcement techniques, comparing their effectiveness in different applications.

CO5: Appraise different grout techniques to recommend stabilization methods for expansive soils.

Pre-requisites : Soil Mechanics and Foundation Engineering

CO/PO Mapping

(S/M/W indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	S	M	M									M	M
CO2	M	M	S											M
CO3	M	M	S	M									S	
CO4	M	M	S	M	M		M	M					M	
CO5	M	M	M				M	M	M			M	M	

Course Assessment methods:

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable)
3. End Semester Examination

INTRODUCTION **9 Hours**

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.

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DRAINAGE AND DEWATERING **9 Hours**

Drainage techniques - Well points - Vaccum and electroosmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).

INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS **9 Hours**

nsitu densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

EARTH REINFORCEMENT **9 Hours**

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.

GROUT TECHNIQUES **9 Hours**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilisation with cement, lime and chemicals - Stabilisation of expansive soils.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCE BOOKS:

1. Koerner, R. M. (2012). Construction and Geotechnical Methods in Foundation Engineering. McGraw-Hill.
2. Purushothama Raj, P. (2018). Ground Improvement Techniques (2nd ed.). Tata McGraw-Hill Education.
3. Moseley, M. P. (2015). Ground Improvement (3rd ed.). Blockie Academic and Professional, Taylor & Francis.
4. Jones, J. E. P. (2012). Earth Reinforcement and Soil Structure (2nd ed.). Butterworth-Heinemann.
5. Koerner, R. M. (2012). Design with Geosynthetics (3rd ed.). Prentice Hall.
6. Jewell, R. A. (2007). Soil Reinforcement with Geotextiles (2nd ed.). Thomas Telford Publishing.

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