

22EYA01 - PROFESSIONAL COMMUNICATION - I (Common to All Branches)					
		L	T	P	C
		2	0	2	3
PREREQUISITE : NIL					
Course Objectives			Course Outcomes		
1.0	To build essential English skills to address the challenges of communication in today's work environment.		1.1	The students will be able to apply knowledge of communication and language processes occur in various work environment.	
2.0	To comprehend the various dimensions of communication by employing LSRW skills.		2.1	The students will be able to involve in diverse discourse forms utilizing LSRW skills.	
3.0	To deploy students in contextual initiatives by assisting them in developing communication abilities.		3.1	The students will be able to participate actively in communication activities that enhance their creative skill.	
4.0	To facilitate students in comprehending the intent, target audience and environments of various forms of communication.		4.1	The students will be able to associate with the target audience and contexts using varied types of communication.	
5.0	To enhance coherence, cohesion, and proficiency in both verbal and nonverbal communication in the workplace environment.		5.1	The students will be able to convey the idea distinctly both in verbal and non verbal communication in work culture.	

UNIT I - INTRODUCTORY SKILLS	(6+6)
Grammar - Parts of Speech - Verb (Auxiliaries - Primary & Modal, Main Verb) - Listening - Listening to Short Conversations or Monologues - Listening to Experiences - Listening to Descriptions - Speaking - Introducing Oneself - Exchanging Personal information - Talking about food and culture - Reading - Reading for Interrogation - Reading Newspaper, Advertisements and Interpreting - Writing - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II - LANGUAGE ACUMEN	(6+6)
Grammar - Word Formation - Tenses (Present Tense) - Synonyms & Antonyms - Listening - Listening to Announcements - Listening to Interviews - Listening and Note-taking - Speaking - Talking about Holidays & Vacations - Narrating Unforgettable Anecdotes - Reading - Skimming - Scanning (Short Texts and Longer Passages) - Critical Reading - Writing - Instruction - Process Description	
UNIT III - COMMUNICATION ROOTERS	(6+6)
Grammar - Cause and Effect - Tenses (Past Tense) - Discourse Markers - Listening - Listening to Telephonic Conversations - Listening to Podcasts - Speaking - Talking about neoteric Technologies - Eliciting information to fill a form - Reading - Book Reading (Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - Writing - Checklist - Circular, Agenda & Minutes of the Meeting	
UNIT IV - DISCOURSE FORTE	(6+6)

Grammar - Tenses (Future Tense) - Yes/No & WH type questions - Negatives - Listening - Listening to TED/ Ink talks - Speaking - Participating in Short Conversations - Reading - Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - Writing - E-Mail Writing	
UNIT V - LINGUISTIC COMPETENCIES	(6+6)
Grammar - Articles - Homophones & Homonyms - Single line Definition - Phrasal Verb - Listening - Intensive listening to fill in the gapped text - Speaking - Expressing opinions through Situations & Role play Reading - Cloze Texts - Writing - Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY	
<ol style="list-style-type: none"> 1. Grammar 2. Listening Skills 3. Speaking Skills 4. Reading Skills 5. Writing Skills 	
TOTAL (L:30, P:30) = 60 PERIODS	

TEXT BOOK:
1. Shoba K N., Deepa Mary Francis, "English for Engineers and Technologists", Volume I, 3rd Edition, Orient Black Swan Pvt. Ltd, Telangana, 2022.
REFERENCES:
<ol style="list-style-type: none"> 1. Koneru, Aruna, "English Language Skills", Tata McGraw Hill Education (India) Private Limited, Chennai, 2006. 2. Hewings M, "Advanced English Grammar", Cambridge University Press, Chennai, 2000. 3. Jack C Richards, Jonathan Hull and Susan Proctor, "Interchange", Cambridge University Press, New Delhi, 2015 (Reprint 2021).

Mapping of COs with POs / PSOs														
Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									3	3		2	2	
2									3	3		2	2	
3									3	3		2	2	
4									3	3		2	2	
5									3	3		2	2	
CO (W.A)									3	3		2	2	

22MEC01 - ENGINEERING GRAPHICS
(Common to AGRI, CIVIL, CHEMICAL and EEE Branches)

	L	T	P	C
	2	0	2	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To Construct various plane curves	1.1	The students will be able to construct various plane curves.
2.0	To Construct the concept of projection of points, lines and plane	2.1	The students will be able to create the projection of points, lines and planes.
3.0	To Develop the projection of solids	3.1	The students will be able to develop projection of solids.
4.0	To Solve problems in sectioning of solids and developing the surfaces	4.1	The students will be able to solve problems in sections of solids and development of surfaces.
5.0	To Apply the concepts of orthographic and isometric	5.1	The students will be able to apply the concepts of isometric in engineering practice.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - use of drafting instruments - BIS conventions and specifications - size, layout and folding of drawing sheets - lettering and dimensioning - scales.

UNIT I - PLANE CURVES

(6+6)

Basic geometrical constructions, curves used in engineering practices - conics - construction of ellipse, parabola and hyperbola by eccentricity method - construction of cycloid - construction of involutes of square and circle - drawing of tangents and normal to the above curves - theory of projection - principle of multi-view orthographic projection - profile plane and side views - multiple views - representation of three dimensional objects - layout of views.

UNIT II - PROJECTION OF POINTS, LINES AND PLANES

(6+6)

Principal planes - first angle projection - projection of points - projection of straight lines (only first angle projections) inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III - PROJECTION OF SOLIDS

(6+6)

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and parallel to another by rotating object method.

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

(6+6)

Sectioning of solids (prism, cube, pyramid, cylinder and cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section - development of lateral surfaces of simple and sectioned solids - prisms, pyramids cylinder and cone.

UNIT V - ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS

(6+6)

Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinders, cones - free hand sketching of orthographic views from isometric views of objects.

TOTAL (L:30+P:30) : 60 PERIODS

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna, "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. Luzzader, Warren.J, and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	-	1	-	-	-	2	-	3	2	1
2	3	2	1	-	-	1	-	-	-	2	-	3	2	2
3	3	2	1	-	-	1	-	-	-	2	-	3	3	1
4	3	2	1	-	-	1	-	-	-	2	-	3	2	1
5	3	3	1	-	-	1	-	-	-	2	-	3	3	2
CO (W.A)	3	2.2	1	-	-	1	-	-	-	2	-	3	2.2	1.6

22EYA02 - PROFESSIONAL COMMUNICATION - II (Common to All Branches)					
		L	T	P	C
		2	0	2	3
PREREQUISITE : 22EYA01					
Course Objectives			Course Outcomes		
1.0	To familiarize the students with the basic structures of English and to train them to use these elements correctly in speaking and writing	1.1	The students will be able to frame sentences both in written and spoken forms with accuracy and fluency.		
2.0	To acquire proficiency in LSRW skills on par with the expectations of the industry.	2.1	The students will be able to attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.		
3.0	To enable students to adopt strategies for enhancing vocabulary, language and fluency and to deliver professional presentations.	3.1	The students will be able to gain essential competency to express one's thoughts orally and in writing in a meaningful way.		
4.0	To communicate effectively in an academic setting using the language skills as tools.	4.1	The students will be able to use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.		
5.0	To acquire necessary language skills to follow and comprehend discourse such as lectures conversations, interviews, and discussions.	5.1	The students will be able to perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.		

UNIT I - LANGUAGE RUDIMENTS	(6+6)
Grammar - Active and Passive Voice – Impersonal Passive Voice - Numerical Expressions - Listening - Listening for Specific Information and Match / Choose / Fill in the texts - Speaking - Describing a Person - Making Plans - Reading - Intensive Reading - Writing - Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	(6+6)
Grammar – Reported Speech – Infinitive and Gerund - Listening – Listening to Iconic Speeches and making notes - Listening news / documentaries - Speaking –Talking over Phone – Narrating Incidents - Reading – Extensive Reading (Motivational Books) - Writing – Recommendation	
UNIT III -TECHNICAL CORRESPONDENCE	(6+6)
Grammar – If Conditionals – Blended Words - Listening – Listening to business conversation on audio and video of Short Films, News, Biographies - Speaking – Synchronous communication and Asynchronous communication – Opportunities and threats in using digital platform- Reading - Finding key information in a given text - Writing –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	(6+6)
Grammar – Concord – Compound Words - Listening – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - Speaking – Introduction to Technical Presentation - Story Telling - Reading – Reading and Understanding Technical Articles - Writing – Report Writing (Accident, Survey and feasibility)	
UNIT V - LANGUAGE BOOSTERS	(6+6)
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - Listening – Listening to different kinds of Interviews - Listening to Group Discussion - Speaking – Group Discussion - Reading – Reading and Interpreting Visual Materials - Writing – Analytical Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Grammar
2. Listening Skills
3. Speaking Skills
4. Reading Skills
5. Writing Skills

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOK:

1. Sudharshana, N.P and Saveetha.C, “English for Technical Communication”, Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf, “Effective Technical Communication”, 2nd Edition, McGraw Hill Education India Pvt Ltd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds, “A Student's Introduction to English Grammar”, 2nd Edition, Cambridge University Press, New Delhi, 2022

WEB REFERENCE:

1. <http://youtu.be/URtdGiutVew>

Mapping of COs with POs / PSOs														
Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									3	3		2	2	
2									3	3		2	2	
3									3	3		2	2	
4									3	3		2	2	
5									3	3		2	2	
CO (W.A)									3	3		2	2	



22CEC01 - FUNDAMENTALS OF ENGINEERING MECHANICS					
		L	T	P	C
		2	1	0	3
PREREQUISITE : NIL					
Course Objectives		Course Outcomes			
1.0	To learn the scalar and vector representation of forces and moments.	1.1	The students will be able to compute the resultant force for various force systems using laws of mechanics.		
2.0	To introduce the equilibrium of rigid bodies	2.1	The students will be able to calculate the moment produced by various force systems and conclude the static equilibrium equations for rigid body system		
3.0	To study and understand the meaning of distributed forces	3.1	The students will be able to evaluate the sectional properties of surfaces and solids		
4.0	To introduces the phenomenon of friction and its effects.	4.1	The students will be able to apply the concepts of frictional forces at the contact surfaces of various engineering systems.		
5.0	To Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar	5.1	The students will be able to apply the different principles to study the motion of a body and analyse their constitutive equations		

UNIT I - BASICS AND STATICS OF PARTICLES	(6+3)
Introduction - Units and Dimensions - Laws of Mechanics - Lamé's theorem, Parallelogram and triangular Law of forces - Principle of Transmissibility - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces.	
UNIT II - EQUILIBRIUM OF RIGID BODIES	(6+3)
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments - Moment of a force about a point and about an axis - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions.	
UNIT III - PROPERTIES OF SURFACES AND SOLIDS	(6+3)
Determination of Areas and Volumes - Centre of Gravity - First moment of area, Second moment of area and Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Principal moments of inertia of plane areas - Principal axes of inertia.	
UNIT IV - FRICTION	(6+3)
Surface Friction - Frictional force - Laws of Coulomb friction - Angle of friction - cone of friction - Simple contact friction - Ladder friction - Rolling Resistance - Problems involving the equilibrium of rigid bodies with frictional forces.	
UNIT V - DYNAMICS OF PARTICLES	(6+3)
Kinematics - Relative motion - Curvilinear motion, Kinetics - Displacements, Velocity and acceleration, their relationship - Newton's laws of motion - Work Energy Equation.	
TOTAL (L:30+T:15) = 45 PERIODS	

TEXTBOOKS:
<ol style="list-style-type: none"> 1. N. Koteeswaran, "Engineering Mechanics", Sri Balaji Publications, 2017. 2. R. K. Bansal, "A Textbook of Engineering Mechanics", Laxmi Publications (P) Ltd, New Delhi, 6th Edition, 2015
REFERENCES:
<ol style="list-style-type: none"> 1. Beer Ferdinand P., Russel Johnston Jr., David F. Mazure, Philip J. Cornwell, Sanjeev Sanghi, "Vector Mechanics for Engineers: Statics and Dynamics", 12th Edition, McGraw Hill Education, Chennai, 2019. 2. Irving H. Shames, " Engineering Mechanics - Statics and Dynamics", 4th Edition, Pearson Education Asia Pvt. Ltd., 2005 3. M. S. Palanisamy and S. Nagan, "Engineering Mechanics - Statics & Dynamics", TMH Publishing Company, 2005

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2			3	2	2	3	2	2	1	3
2	3	3	2	2	3	2	3	2		1		2	2	2
3	3	3	2	2	2		2	2	2	3	3	3	2	3
4	3	3	2	2	2	2	3	2		3	2	3	1	2
5	3	2	2	1	2	2	2	2	1	2		2	2	2
CO (W.A)	3.0	2.8	2	1.8	2.25	2	2.6	2	1.67	2.4	2.33	2.4	1.6	2.4

Signature

22CYB08 - ENVIRONMENT AND SUSTAINABILITY

L	T	P	C
2	0	0	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To recognize the basic concepts of environment, ecosystems and biodiversity.	1.1	The students will be able to know the importance of environment and functions ecosystems and biodiversity
2.0	To impart knowledge on the causes, effects and control measures of environmental pollution.	2.1	The students will be able to identify the causes, effects of environmental pollution and contribute the preventive measures to the society.
3.0	To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.	3.1	The students will be able to identify and understand the renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4.0	To familiarize the concept of sustainable development goals, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.	4.1	The students will be able to recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
5.0	To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyzes the role of sustainable urbanization.	5.1	The students will be able to demonstrate the sustainability practices and identify green materials, energy cycles.

UNIT I - ENVIRONMENT AND BIODIVERSITY	(6)
Environment - scope and importance - Eco-system: Structure and function of an ecosystem - types of biodiversity - genetic - species and ecosystem diversity - values of biodiversity - hot-spots of biodiversity - conservation of biodiversity: In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(6)
Pollution - Causes - Effects and Preventive measures of Water, Air and noise pollution - Solid waste management: methods of disposal of solid waste - Environmental protection act: Air act - Water act.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(6)
Energy management and conservation - New Energy Sources: Different types of new energy sources - Solar energy - wind energy - Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion.	
UNIT IV - SUSTAINABILITY AND MANAGEMENT	(6)
Development - Factors affecting development - advantages - disadvantages - GDP - Sustainability - needs - concept - concept of carbon credit - carbon footprint - Environmental management.	
UNIT V - SUSTAINABILITY PRACTICES	(6)
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable energy: Energy Cycles- carbon cycle and carbon emission - Green Engineering: Sustainable urbanization.	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, "Environmental Science and Engineering", Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai, 15th Edition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.

REFERENCES:

1. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEBLINK:

1. <http://www.jnkvv.org/PDF/08042020215128Amit1.pdf>
2. <https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php>
3. <https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/>

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2			3	3	2	1			2		
2	2	2	2			3	3	2	1			2		
3	2	2	2			3	3	2	1			2		
4	2	2	2			3	3	2	1			2		
5	2	2	2			3	3	2	1			2		
CO (W.A)	2	2	2			3	3	2	1			2		



- Approved by Eleventh Academic Council

17CEC01- FUNDAMENTALS OF ENGINEERING MECHANICS					
		L	T	P	C
		3	2	0	4
PREREQUISITE : NIL		QUESTION PATTERN: TYPE - 3			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To understand the scalar and vector representation of forces and moments.	1.1	Understand the Equilibrium of a particle and Forces in space	a,b,f,i,k	
2.0	To apply static equilibrium of particles and rigid bodies in two dimensions	2.1	Analyze the problems in static equilibrium of particles and rigid bodies in two dimensions	a,c,f,j	
3.0	Understand the meaning of centre of gravity (mass) / Centroid and Moment of Inertia	3.1	Evaluate various sectional properties like Centroid, Moment of Inertia	a,d,i,k	
4.0	To communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem	4.1	Identify with the laws of motion, the kinematics of motion and the interrelationship	a,b,f,k	
5.0	To understand the principle of work and energy, laws of motion & kinematics of motion	5.1	Realize the effect of friction on equilibrium.	a,b,c,i,l	

UNIT I - BASICS AND STATICS OF PARTICLES	(9+6)
Introduction - Units and Dimensions - Laws of Mechanics - Lamé's theorem, Parallelogram and triangular Law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces.	
UNIT II - EQUILIBRIUM OF RIGID BODIES	(9+6)
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments - Moment of a force about a point and about an axis - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions.	
UNIT III - PROPERTIES OF SURFACES AND SOLIDS	(9+6)
Determination of Areas and Volumes - Centre of Gravity - First moment of area, Second moment of area and Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia.	
UNIT IV - DYNAMICS OF PARTICLES	(9+6)
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation.	
UNIT V- FRICTION	(9+6)
Frictional force - Laws of Coulomb friction - Angle of friction - cone of friction - Simple contact friction - Ladder friction - Rolling Resistance - Problems involving the equilibrium of rigid bodies with frictional forces.	
TOTAL (L:45+T:30) = 75 PERIODS (AUTONOMOUS) ERODE-52	

TEXT BOOKS:

1. Dr. N. Koteeswaran, "Engineering Mechanics", Sri Balaji Publications, Coimbatore, 2013.
2. Dr. R. K. Bansal "A Textbook of Engineering Mechanics", Laxmi Publications (P) Ltd, New Delhi, 6th ed., 2015.

REFERENCES:

1. M.S. Palanichamy and S. Nagam, "Engineering Mechanics - Statics & Dynamics", 3rd ed., Tata McGraw-Hill, 2004.
2. S. Rajasekaran, G. Sankarasubramanian, "Fundamentals of Engineering Mechanics", 3rd ed., Vikas Publishing House Pvt. Ltd, 2009.
3. F. P. Beer and E. R. Johnson, Vector Mechanics for Engineers, Vol I - Statics, Vol II Dynamics, 9th ed., Tata McGraw Hill, India, 2011
4. Irving H. Shames, "Engineering Mechanics - Statics and Dynamics", 4th ed., Pearson Education Asia Pvt. Ltd., 2005.



17MYB02 - COMPLEX ANALYSIS AND LAPLACE TRANSFORMS
(Common to All branches)

L	T	P	C
3	2	0	4

PREREQUISITE : 17MYB01

QUESTION PATTERN : TYPE - 4

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To expose the concepts of differential equations.	1.1	Predict the suitable method to solve second and higher order differential equations.	a,b,c,d,f,i,k
2.0	To communicate the problem solutions using correct Mathematical terminology of vector calculus.	2.1	Apply the concepts of Differentiation and Integration to Vectors.	a,b,c,f,g,k
3.0	Apply rigorous and analytic approach to analyse the conformal mapping.	3.1	Compute an analytic function, when its real or imaginary part is known.	a,b,c,d,e,i,k
4.0	Acquiring the knowledge of evaluating contour integrals using residue theorem.	4.1	Identify the Singularities and its corresponding Residues for the given function.	a,b,c,d,e,k
5.0	Apply the concepts of Laplace transforms & its applications to various problems related to Engineering.	5.1	Predict a suitable method to evaluate the Contour integration.	a,b,c,d,e,f,i,k

UNIT I - ORDINARY DIFFERENTIAL EQUATIONS

(9+6)

Higher order linear differential equations with constant coefficients - method of variation of parameters - Cauchy's and Legendre's linear equations

UNIT II - VECTOR CALCULUS

(9+6)

Gradient and Directional derivative - Divergence and Curl - Irrotational, solenoidal and scalar potential - Line integral over a plane curve - Surface Integral and Volume Integral - Green's theorem in a plane - Gauss divergence theorem and Stokes Theorem (Excluding Proofs) - Simple Applications Involving Square, Rectangles, Cube and Parallelepiped.

UNIT III- ANALYTIC FUNCTIONS

(9+6)

Functions of a complex variable - Analytic functions - Necessary and sufficient conditions of Cauchy's - Riemann Equations in Cartesian Coordinates (Excluding Proofs) - Properties of Analytic Functions - Harmonic conjugate - Construction of an analytic function by Milne's Thomson Method - Conformal mapping $w = c+z$, cz , $1/z$ and Bilinear Transformation.

UNIT IV - COMPLEX INTEGRATION

(9+6)

Statement and Simple applications of Cauchy's integral theorem and Cauchy's integral formula (Excluding Proofs) - Taylor's and Laurent's Series Expansions - Singularities - Residues - Cauchy's Residue theorem (Statement only) - Evaluation of contour integration over unit circle and semi circle (Excluding poles on Real axis).

UNIT V- LAPLACE TRANSFORM

(9+6)

Condition for existence - Transforms of Elementary functions - Basic Properties - First & Second Shifting Theorems (Statement only) - Transforms of derivatives and integrals - Transform of periodic functions - Initial and Final value Theorems. Inverse Laplace transforms - Convolution theorem (Statement only) - Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.

TOTAL (L: 45+T:30) = 75 PERIODS



Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software

TEXTBOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley and sons, 2013
3. Veerarajan.T, "Engineering Mathematics for Semester I and II", 3rd Edition, Tata McGraw Hill, 2014

REFERENCES:

1. N.P.Bali and Manish Goyal, "A text book of Engineering Mathematics : Semester-II", 5th Edition, Laxmi Publications, 2011
2. Kandasamy P, Thilagavathy K and Gunavathy .K, "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand and Co Ltd, 2013
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007




Dr.N.Rengarajan, B.Sc., B.Tech., M.E., Ph.D.,

PRINCIPAL
NANDHA ENGINEERING COLLEGE

(Autonomous) Approved by Eighth Academic Council

ERODE - 638 052.

17EEEC01- BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to AGRI, CIVIL and Chemical Branches)					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL		QUESTION PATTERN : TYPE - 3			
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes The students will be able to		Related Program outcomes	
1.0	To impart knowledge on electric circuit laws, single phase circuits and measuring instruments.	1.1	Apply the basic laws and investigates the behavior of electric circuits by analytical instruments.	a,b,d,f	
2.0	To learn the basic principles of electrical machines and their performance.	2.1	Identify the electrical components and explore the characteristics of electrical machines.	a,b,d,f	
3.0	To expound the fundamentals of semiconductor and applications.	3.1	Analyze the various characteristics of semiconductor devices and applications.	a,b,c,e,f	
4.0	To introduce the fundamentals of digital circuits, combinational and sequential circuit.	4.1	Expose the concept of digital electronics	a,c,e,f	
5.0	To impart knowledge on communication systems.	5.1	Understand the fundamental of communication systems.	a,c,e,f	

UNIT I - ELECTRICAL CIRCUITS AND MEASUREMENTS	(9)
Ohm's Law – Kirchhoff's Laws – Mesh and Nodal analysis– Introduction to AC circuits – Power and Power factor - Classification of instruments – Operating principles of moving coil, moving iron instruments and dynamometer type wattmeter - Induction type energy meter.	
UNIT II - ELECTRICAL MACHINES	(9)
DC Generator - DC Motor - Single phase transformer - Single phase induction motor; construction, principle of operation, basic equations and applications.	
UNIT III - SEMICONDUCTOR DEVICES AND APPLICATIONS	(9)
Introduction - Characteristics of PN junction diode and Zener diode - Half wave and Full wave rectifier – Bipolar junction transistor; CB, CE, CC configurations and characteristics.	
UNIT IV - DIGITAL ELECTRONICS	(9)
Binary number system - Logic gates – Boolean laws –Half and Full adders – Introduction to sequential circuits: Flip-Flops (RS, D, T and JK), shift registers and counters - ADC and DAC.	
UNIT V - FUNDAMENTALS OF COMMUNICATION ENGINEERING	(9)
Introduction - Elements of communication systems - Amplitude and Frequency modulation -Demodulation - Communication systems Radio, TV, ISDN, Microwave, Satellite and Optical fibre. (Block Diagram Approach only)	
TOTAL (L: 45) = 45 PERIODS	
TEXT BOOKS:	
1. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016.	
2. R.Muthusubramaian, S.Salivahanan and K.A.Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2 nd ed., Tata MCGraw Hill. 2012.	

REFERENCES:

1. Sedha R.S., "Applied Electronics", S. Chand & Co., 2008.
2. Mittle and V. N. Mittle, "Basic Electrical Engineering", Tata McGraw Hill, New Delhi, 2005.
3. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson India, 2011.
4. Nageswara Rao.T, "Circuit Theory", A.R. Publications, Chennai, 2014.




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17MYB03 - FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS (Common to BE - MECH / CIVIL / CHEMICAL / AGRI)					
		L	T	P	C
		2	2	0	3
PREREQUISITE : NIL			QUESTION PATTERN : TYPE – 4		
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To acquire knowledge to solve half range Fourier series and harmonic analysis.	1.1	Ability to have fundamental understanding of Fourier series and give Fourier expansions of a given function.		a,b,c,d,k,l
2.0	To understand the concept of Fourier transforms and enhance the problem solving skill.	2.1	Apply transform techniques to solve engineering problems.		a,b,c,f,g
3.0	To introduce how to solve linear partial differential equations with different methods.	3.1	Analyze and simulate the first and second order linear partial differential equations.		a,b,c,i,k,l
4.0	To get the analytical solution for second and higher order homogeneous linear PDE's.	4.1	Demonstrate a firm understanding of the solution techniques for homogeneous linear PDE's.		a,b,c,d,e,l
5.0	To solve different forms of wave and heat equations.	5.1	Ability to apply partial differential techniques to solve the physical engineering problems.		a,b,c,d,k

UNIT I - FOURIER SERIES	(6+6)
Dirichlet's conditions - Fourier series: Half range sine series - Half range cosine series - Parseval's identity for half range series - Root-Mean square value of a function - Harmonic Analysis (π , degree and T- forms).	
UNIT II - FOURIER TRANSFORMS	(6+6)
Fourier integral theorem (statement only) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions - Convolution theorem.	
UNIT III - FIRST ORDER NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS	(6+6)
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations: (i) $f(p,q)=0$, (ii) Clairaut's type, (iii) $f(z,p,q) = 0$, (iv) $f(x,p) = g(y,q)$.	
UNIT IV - LINEAR PARTIAL DIFFERENTIAL EQUATIONS	(6+6)
General solution of Lagrange's linear equation $Pp+Qq = R$ - Solutions of simultaneous equations $dx/P=dy/Q =dz/R$ by the method of grouping & method of multipliers-Homogeneous linear partial differential equations of second and higher order with constant coefficients (R.H.S = 0, e^{ax+by} , $\cos(ax+by)$, $\sin(ax+by)$, x^2y^2).	
UNIT V - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	(6+6)
Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation(zero and Non-zero Boundary conditions) - One dimensional heat equation(Reduced to zero & non zero temperature)- Steady state solution of two dimensional heat equation (Finite and infinite plate).	
TOTAL (L: 30+T:30) = 60 PERIODS	

TEXT BOOKS:

1. Veerarajan, T. "Transforms and Partial Differential Equations", 2nd ed., Tata Mc Graw Hill, New Delhi, Second reprint, 2015.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics; Volume III", S. Chand & Co Ltd., 2008.

REFERENCES:

1. Goyal, Manish and Bal, N.P., "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012.
2. Grewal, B.S. "Higher Engineering Mathematics", 42nd ed. Khanna publishers, New Delhi, 2012.
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.



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17CEC03 - MECHANICS OF SOLIDS - I					
		L	T	P	C
		3	2	0	4
PREREQUISITE : 17CEC01		QUESTION PATTERN: TYPE -4			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To know fundamental concepts of stress, strain and deformation of solids with applications to bars and beams	1.1	Study the concepts of stress ,strain and deformation of solids	a,b,l	
2.0	To analyze plane truss and determine the deflection of beams	2.1	Analyze the plane truss members using various methods	a,b,l	
3.0	To draw the bending moment and shear force diagram for different types of beams.	3.1	Able to draw the bending moment and shear force diagram	a,b,c,i,l	
4.0	To calculate the deflection of beams by various methods	4.1	Analyze the slope and deflection of beams by various methods	a,b,d	
5.0	To study the concepts of theory of torsion and springs	5.1	Understand the concept of stresses in shafts and springs	a,b,e	

UNIT I - SIMPLE STRESSES AND STRAINS	(9+6)
Stress and Strain due to axial load – Elastic limit – Hooke's law – stress – strain diagram – Stresses in Composite Sections - Poisson's ratio – Shear Stress and Shear Strain – Rigidity Modulus – Volumetric Strain – Bulk Modulus – Relation between elastic constants – Principal Stresses and Strains – Principal Planes.	
UNIT II - ANALYSIS OF PLANE TRUSS	(9+6)
Stability and equilibrium of plane frames – types of trusses – analysis of forces in truss members method of joints, method of tension coefficients and method of sections.	
UNIT III - STATICALLY DETERMINATE BEAMS	(9+6)
Types of beams and supports –shear force and bending moment diagrams for cantilever, simply supported and over hanging beams – Theory of simple bending – bending stress and shear stress in rectangular, I sections beams	
UNIT IV - DEFLECTION OF BEAMS	(9+6)
Slope and Deflection of beams using Double Integration Method, Macaulay's Method, Moment Area Method and Conjugate Beam Method	
UNIT V - TORSION OF CIRCULAR SHAFTS AND SPRINGS	(9+6)
Torsion Equation – Assumptions – Theory of Torsion – Stresses in Solid and Hollow Circular Shafts – Power transmitted by the shaft –Types of Springs – Deformations and Stresses in closed and open coiled Helical Springs.	
TOTAL (L: 45 + T:30) = 75 PERIODS	
TEXT BOOKS:	
1. Bansal,R.K, "Strength of Materials", Laxmi Publications, New Delhi, 2015.	
2. Rajput,R.K "Strength of Materials", S. Chand Publications, New Delhi, 2014.	


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REFERENCES:

1. Bhavikatti S.S, "Mechanics of Solids", New Age International, New Delhi, 2010.
2. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2009
3. Srinath L.S, "Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2009.
4. Subramanian.R "Strength of Materials", Oxford University Press, New Delhi, 2010.




Principles
of
Strength of Materials
Part - I
Dr. N. Jayaram

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17CEC04 - MECHANICS OF FLUIDS						
			L	T	P	C
			3	0	0	3
PREREQUISITE : NIL			QUESTION PATTERN: TYPE -4			
COURSE OBJECTIVES AND OUTCOMES						
Course Objectives		Course Outcomes			Related Program outcomes	
		The students will be able to				
1.0	To understand the properties of fluids, fluid statics.	1.1	Understand the basic properties of fluids and their applications	b,d		
2.0	To solve kinematic problems such as finding particle paths and stream lines.	2.1	Understand the concepts of static, kinematic and dynamics of fluid flow.	a,b,d		
3.0	To study about flow through pipes and pipe networks and boundary layer concepts.	3.1	Learn types of flow and losses of flow in pipes.	a,b,f		
4.0	To understand the application of model study.	4.1	Get idea about dimensional and model analysis	b,d		
5.0	To analyze and appreciate the complexities involved in solving the fluid flow problems.	5.1	Understand and solve the boundary layer problems	a,b,f		

UNIT I - FLUID PROPERTIES AND HYDROSTATICS	(9)
Density – Viscosity – Surface tension – compressibility – capillarity – Measurement of pressure- Hydrostatic forces on plane – inclined and curved surfaces – buoyancy – centre of buoyancy – metacentre.	
UNIT II - FLUID KINEMATICS AND DYNAMICS	(9)
Control volume– Fluid Kinematics - Types of flows: Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows– Streamline and Velocity potential lines - Euler and Bernoulli's equations and their applications – moment of momentum – Momentum and Energy correction factors Impulse – Momentum equation-Navier-Stokes Equations-Applications.	
UNIT III - FLOW THROUGH PIPES	(9)
Flow through pipes – Open Channels and Measurement pipe flow: Major and Minor losses – Multi reservoir problems – pipe network design – Moody's diagram – Hagen Poiseuille equation – Turbulent flow. Specific Energy – Critical flow concept – specific force – Hydraulic jump – Pipes in series and in parallel	
UNIT IV- DIMENSIONAL ANALYSIS AND MODEL LAWS	(9)
Fundamental dimensions–Dimensional homogeneity – Rayleigh's and Buckingham π theorems – Non-dimensional numbers – Model laws and distorted models.	
UNIT V- BOUNDARY LAYERS AND SEPARATION	(9)
Boundary layers – Laminar flow and Turbulent flow – Boundary layer thickness – momentum – Integral equation– Drag and lift-Separation of boundary layer-Methods of separation of boundary layer.	
TOTAL (L: 45) = 45 PERIODS	


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TEXT BOOKS:

1. Bansal.R.K. 'Fluid Mechanics and Hydraulic Machines', 9th ed., Laxmi Publications, New Delhi, 2015.
2. Vijay Gupta and Santhosh Kumar Gupta, 'Fluid Mechanics and Applications', 2nd ed., New Age International, Reprint 2012.

REFERENCES:

1. Kumar.D.S. 'Fluid Mechanics and Fluid Power Engineering', S K Kataria and Sons, New Delhi, 2013.
2. Modi.P.N, 'Hydraulics and Fluid Mechanics including Hydraulic Machines', 19th Revised and Enlarged ed., Standard Publishers Distributors, 2013.
3. Victor Streeter, E. Benjamin Wylie and K.W. Bedford, 'Fluid Mechanics', 9th ed., Tata McGraw – Hill Education, New Delhi 2010.



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17CEC05 – BUILDING MATERIALS					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL		QUESTION PATTERN: TYPE -3			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	To have a clear knowledge of building materials and their properties.	1.1	Compare the properties of most common and advanced building materials.	e,i	
2.0	To get idea on joineries and plumbing materials.	2.1	Understand the applications of glass, timbers and other materials	a,b,e	
3.0	To learn the criteria for choice of the appropriate material and	3.1	Know the types and application of joineries and plumbing materials	a,e,i	
4.0	To conduct the various tests for assessing the strength and quality of materials.	4.1	Get idea on roofing and flooring materials	a,e,i	
5.0	To apply the theoretical knowledge to practical problems.	5.1	Understand the importance of modern material for construction.	a,e,i	

UNIT I - BRICKS AND CONCRETE BLOCKS	(9)
Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, brick and Concrete hollow blocks – Light weight concrete blocks (AAC).	
UNIT II - GLASS, TIMBER AND OTHER MATERIALS	(9)
Glass - Types and its application - Timber – Market forms – Industrial timber– Plywood – Veneer – False ceiling materials – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.	
UNIT III - JOINERIES AND PLUMBING	(10)
Doors – Types – Based on materials – Wood, UPVC, Glazed, Fiber reinforced plastic, Steel, Puff, Flush, Aluminium - Based on usage – Pocket, Bi-fold, Sliding, Accordion – Based on manufacturing process - Battened and Lugged Doors, Framed and Panelled Doors, Battened, Lugged and Braced Doors, Flush Doors, Louvered Doors.	
Windows – Types - Based on materials – Wood, UPVC, Steel, Glass, Aluminium - Based on usage – Fixed, Sliding, Casement, Hopper, Single hung, Awing, Bay, Bow.	
Plumbing – Types of pipes and its application – Specials – Tee, Elbow, cap, reducer, union, FTA, Y, Nani trap, Q-trap, S-trap, Cowel - Basic plumbing fitting, types and its applications – Water closets, Taps, wash basins, Health Faucet, bib cock, angle valve.	
UNIT IV - FLOORING AND ROOFING MATERIALS	(8)
Flooring – Types of Flooring – Materials Used and its source, properties and application – Granite, Marble, Vitrified and ceramic Tile, Kota stone, Mandana – Grano, Epoxy flooring - Roofing Material – Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials	

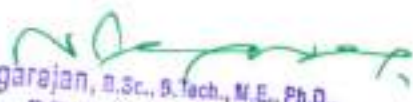
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UNIT V- MODERN CONSTRUCTION MATERIALS	(9)
Structural Steel and Aluminium – Modern materials – Neoprene, thermocole, decorative panels and laminates, architectural glass and ceramics, ferrocement, PVC, polymer base materials, fibre reinforced plastics – Grouting materials - Sealants for joints - Composite materials – Types – Applications of lamiriar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement - colour coated sheets, insulated wall panels	
LIST OF EXPERIMENTS: <ol style="list-style-type: none"> 1. Determination of tension on mild steel rod. 2. Determination of Double shear on mild steel. 3. Finding out Torsional value of mild steel rod. 4. Determination of Compression strength on timber. 5. Determination of Compression strength on bricks. 6. Determination of Izod and Charpy impact test on metal specimens. 7. Finding out the Rockwell Hardness Number on metal Specimens. 8. Finding out the Brinell hardness test on metal Specimens. 9. Finding out the Deflection values on metal beam on various tests. 10. Determination of Elastic properties of open coiled and close coiled helical springs 	
TOTAL (L: 45 : P:30) = 75 PERIODS	
TEXT BOOKS: <ol style="list-style-type: none"> 1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012. 2. Rangwala.S.C. "Engineering Materials", Charotar Pubfishing House, New Delhi 2014. 3. Duggal.S.K., "Building Materials", 4th ed., New Age International, 2008 	
REFERENCES: <ol style="list-style-type: none"> 1. Rajput.R.K, "Engineering Materials", S. Chand & Company Ltd., 2011. 2. Gambhir. M.L., and Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012. 3. Bindra and Arora, "Building Materials and Construction", Dhanpat Rai & Sons, New Delhi, 1998 	





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17CEC06 – SURVEYING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		QUESTION PATTERN: TYPE -3			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	Understand the concepts of different types of surveying and the procedures for carrying out the survey works.	1.1	Remember the basics of surveying and different methods of surveying.	a,b,l	
2.0	To know about contouring works for construction Purposes.	2.1	Understand the contouring and leveling concepts	a,c,d,g	
3.0	To study the different surveying equipment in the field of civil engineering.	3.1	Understanding the fundamental function, use of Theodolite and tacheometry in practical applications.	a,b,e,l	
4.0	To measure the height and distance by Theodolite	4.1	Get idea about route surveying	a,c,d	
5.0	To get introduced to modern surveying equipment's and its techniques	5.1	Get exposure on advance surveying such as total Station.	b,d,e,l	

UNIT I - HISTORY AND TRADITIONAL METHODS OF SURVEYING	(9)
Definition - Principles - Classification - Conventional signs - Survey instruments - well conditioned triangles - Traversing - Plane table instruments and accessories - Compass - Types - Bearing - weighted observations - Principle of least squares.	
UNIT II - CONTOUR AND LEVELLING	(11)
Level line - Horizontal line - Levels and Staves - Bench marks -Temporary and permanent adjustments - Fly and check Levelling - Reciprocal leveling - Longitudinal and cross sections – Contouring and its characteristics - solve problems by using height of collimation and rise and fall method - Calculation of areas and volumes.	
UNIT III -THEODOLITE SURVEYING	(9)
Theodolite - Horizontal angles - Vertical angles - Heights and distances - Tachometric surveying - Tachometric systems - Tangential stadia - Stadia systems – Horizontal and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia Constants Traversing - Closing error and distribution - Omitted measurements.	
UNIT IV - ROUTE SURVEY AND HYDROGRAPHIC SURVEY	(7)
Reconnaissance, Preliminary and location surveys for engineering projects - Hydrographic Surveying - Tides - MSL – Sounding & its methods.	
UNIT V - TOTAL STATION	(9)
Introduction- Accuracy of a Total Station- Accessories for Total Station- Functions Performed by Total Stations- Applications of Total Station- Remote Elevation Measurement (REM)- Missing Line Measurement (MLM)- Area Calculation- Setting out	
TOTAL (L : 45) = 45 PERIODS	


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TEXT BOOKS:

1. Punmia.B.C. Ashok K. Jain and Arun K. Jain, "Surveying, Vols.I, II and III", 16th ed.,Laxmi Publications, New Delhi, 2005
2. Duggal R.K, "Surveying", Vol. I & II, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.

REFERENCES:

1. Kanetkar.T.P "Surveying and Levelling", Vols. I and II, United Book Corporation, Pune, 1994.



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17MYB07 – NUMERICAL METHODS (Common to Civil and Chemical Engg. branches)				
	L	T	P	C
	2	2	0	3
PREREQUISITE : NIL		QUESTION PATTERN: TYPE -4		
COURSE OBJECTIVES AND OUTCOMES				
Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To derive appropriate numerical methods to solve algebraic and transcendental equation.	1.1	Solve an algebraic or transcendental equation using an appropriate numerical method	a,b,d,k,l
2.0	To find the Lagrange Interpolation Polynomial for any given set of points.	2.1	Numerically approximate functions with Lagrange polynomials	a,e,l
3.0	To apply several methods of numerical differentiation and integration, including Romberg integration.	3.1	Understand and apply appropriate techniques for numerical differentiation and integration.	a,c,d,l
4.0	To find numerical solution of a differential equation by Euler's, Modified Euler's, Predictor Corrector and Runge- Kutta Methods.	4.1	Make use of numerical methods in the solution of ordinary differential equations which are useful in solving engineering problems	a,b,e,l
5.0	To use finite differences for interpolation and differentiation.	5.1	Solve initial value problem ordinary differential equations with explicit or implicit methods as appropriate.	a,b,d,l

UNIT I - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	(6+6)
Solution of equation – Method of criteria for convergence – Newton Raphson method – Solution of linear system by Gaussian elimination– Iterative methods: Gauss-Seidel method — Eigen value of a matrix by power method for symmetric matrix.	
UNIT II - INTERPOLATION AND APPROXIMATION	(6+6)
Divided differences in unequal intervals — Lagrangian Polynomials–Newton's forward and backward difference formulas for equal intervals.	
UNIT III - NUMERICAL DIFFERENTIATION AND INTEGRATION	(6+6)
Numerical integration by Trapezoidal and Simpson's 1/3 rule – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpson's rules.	
UNIT IV - INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	(6+6)
Single step methods; Taylor series method – Euler's method– Modified Euler method for first order equation – Fourth order Runge –Kutta method for solving first order equations –Multistep methods: Adam's and Milne's predictor and corrector methods.	
UNIT V - BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	(6+6)
Finite difference solution of one dimensional heat equations using Crank-Nicolson, Bender Schmidt methods – Onedimensional wave equation and two dimensional Laplace equations using Liebmann's iteration process.	
TOTAL (L:30+ T:30) : 60 PERIODS	


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TEXT BOOKS:

1. T. Veerarajan. and T. Ramachandran., "Numerical Methods with programming in C", 2nd ed., Tata McGraw-Hill, 2006 , First reprint 2007.
2. P. Kandasamy, K.Thilagavathy and K. Gunavathy, "Numerical Methods – Vol: IV", S.Chand& Co. Ltd New Delhi, 2003, reprint 2007.

REFERENCES:

1. K. SankarRao, "Numerical Methods for Scientists and Engineers", 3rd ed., Prentice Hall of India, New Delhi, 2007,10th reprint 2012.
2. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill, New Delhi, 1999, 25th reprint 2008.
3. M.K Venkatraman, "Numerical Methods" National Publication, New Delhi, 2000, reprint 2005.
4. B.S.Grewal,"Numerical Methods in Engineering and Science" ,Khanna publishers ,New Delhi,2012.




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17CEC07 - MECHANICS OF SOLIDS - II					
		L	T	P	C
		3	2	0	4
PREREQUISITE : 17CEC03		QUESTION PATTERN : TYPE - 4			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	To know the method of finding slope and deflection of beams and trusses using energy theorems	1.1	Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.	a,b,i	
2.0	To know the concept of analysing indeterminate beam	2.1	Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation.	a,b,d,i	
3.0	To understand the concepts of columns and cylinders	3.1	Find the load carrying capacity of columns and stresses induced in columns and cylinders.	a,b,c,i	
4.0	To acquire knowledge on the stress in 3D and theories of failure	4.1	Determine principal stresses and planes for an element in three dimensional state of stress and study various theories of failure	a,b,c	
5.0	To study of advanced topics in bending of beams	5.1	Determine the stresses due to unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams.	a,b,d,i	

UNIT I - ENERGY PRINCIPLES	(9+6)
Strain energy - Castigliano's theorems - Principle of virtual work - Application of energy theorems for computing deflections in beams and trusses - Maxwell's reciprocal theorems.	
UNIT II - INDETERMINATE BEAMS	(9+6)
Propped cantilever and fixed beams - Fixed end moments and reactions for concentrated load (central, non-central), uniformly distributed load - Theorem of three moments - Analyses of continuous beams - Shear force and bending moment diagrams for continuous beams.	
UNIT III - COLUMNS AND CYLINDERS	(9+6)
Eccentrically loaded columns - middle third rule - core section - Euler's theory of elastic columns with different end conditions - Rankine-Gordon formula thin cylinders and shells - Thick cylinders - Compound cylinders.	
UNIT IV - STATE OF STRESS IN THREE DIMENSIONS	(9+6)
Determination of principal stresses and principal planes - Volumetric strain - Theories of failure - Mohr's circle of stresses and strains - Application in analysis of stress, load carrying capacity and design of members - Residual stresses.	
UNIT V - UNSYMMETRICAL BENDING AND CURVED BEAMS	(9+6)
Symmetrical and unsymmetrical bending - Bending stress in beams subjected to unsymmetrical bending - Curved beams - Stresses due to bending by Winkler Bach theory - Rectangular, trapezoidal, circular solid sections	
TOTAL (L: 45 + T:30) = 75 PERIODS	

TEXT BOOKS:

1. Bansal.R.K, "Strength of Materials", Laxmi Publications, New Delhi, 2015.
2. Rajput.R.K "Strength of Materials", S. Chand Publications, New Delhi, 2014.

REFERENCES:

1. S.M.A Kazimi, "Solid Mechanics", 26th reprint, Tata McGraw Hill Publishing Co., New Delhi, 2006.
2. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2010
3. PunmiaB.C."Theory of Structures (SMTS) Vol I &II", Laxmi Publications Pvt Ltd, New Delhi, 2017.
4. William A .Nash, "Theory and Problems of Strength of Materials", Schaums Outline Series, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2007.
5. D. S. Bedi, "Strength of Materials", S. Chand & Co. Ltd., 2012



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17CEC08 - SOIL MECHANICS						
			L	T	P	C
			3	0	2	4
PREREQUISITE : 17CEC02			QUESTION PATTERN : TYPE - 4			
COURSE OBJECTIVES AND OUTCOMES						
Course Objectives		Course Outcomes			Related Program outcomes	
		The students will be able to				
1.0	To impart the fundamental concepts of soil mechanics	1.1	Classify the soil and assess the engineering properties, based on index properties.	a,b,d,g,i		
2.0	To understand the role of water in soil behavior and how soil stresses, permeability and quantity of seepage estimated.	2.1	Estimate soil stresses and prepare flow net diagram.	a,b,d		
3.0	To understand the soil stress distribution and stress influence under various loading conditions.	3.1	Do proper stress estimation for various types of foundation loads.	a,b,c,d		
4.0	To estimate the total settlement and time rate of settlement of the soil.	4.1	Understand and identify the settlement in soils.	b,g,i		
5.0	To familiarize about the fundamental concepts in shear strength of soils	5.1	Analyze shear properties of cohesive and cohesionless soils	a,b,i		

UNIT I - WEIGHT VOLUME RELATIONS AND INDEX PROPERTIES	(9)
Soil formation -Three phase diagram - Weight-volume relations - Index properties of soils - Atterberg's limits - Classification of soils - BIS System.	
UNIT II - SOIL WATER AND PERMEABILITY	(9)
Soil water - Effective and neutral stresses - Flow of water through soils - Permeability - Laboratory methods - Darcy's law - Seepage and flow-nets - Quick sand.	
UNIT III - STRESS DISTRIBUTION IN SOILS	(9)
Vertical pressure distribution -Boussinesq's equation for point load and uniformly distributed loads - New mark's influence chart - Westergaard's equation -Isobar diagram - Pressure bulb - Contact pressure distribution.	
UNIT IV - CONSOLIDATION AND COMPACTION	(9)
Compressibility - e-log p curve - Preconsolidation pressure - Primary consolidation - Terzaghi's consolidation theory - Compaction - factors affecting soil compaction - Laboratory compaction tests - dry density and moisture content relationship - field compaction.	
UNIT V - SHEAR STRENGTH OF SOIL	(9)
Shear strength of soils - Stress analysis by Mohr's circle - Mohr's strength theory - Mohr-Coulomb strength envelope - Measurement of shear strength - Direct shear test - Triaxial compression - Unconfined compression test - Vane shear test - Shear strength of saturated cohesive soils - Shear strength of cohesionless soils.	
LIST OF EXPERIMENTS:	
<ol style="list-style-type: none"> 1. Determination of Moisture Content 2. Determination of Specific Gravity of soil 3. Sieve Analysis for Coarse Grained soil 4. Atterberg's Limits 5. Sand replacement Test 	

6. Field Density Test
 - a. Core Cutter Method
 - b. Standard Proctor's Compaction Test.
7. Permeability Test

TOTAL (L: 45+ P:30) = 75 PERIODS

TEXT BOOKS:

1. Arora K.R."Soil Mechanics and Foundation Engineering ", Standard Publishers and Distributors, New Delhi, 2005.
2. Gopal Ranjan and Rao A.S.R." Basic and Applied Soil Mechanics", Wiley Eastern Ltd, New Delhi, 2007.
3. Punmia P.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2005.

REFERENCES:

1. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd ed., Pearson Education, 2013
2. Khan I.H., "A text book of Geotechnical Engineering ", Prentice Hall of India, New Delhi, 2012.
3. Venkatramiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint),

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17CEC09 - HIGHWAY ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		QUESTION PATTERN : TYPE -3			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to		Related Program outcomes	
1.0	To understand the importance of transportation, highway planning, alignment and surveys.	1.1	Carry out surveys involved in planning and highway alignment.	a,c,i	
2.0	To know geometric design of highways.	2.1	Design various geometric elements of highways.	b,i	
3.0	To know about the highway materials and its construction.	3.1	Analyse the various characteristics of highway materials and test this quality	c,d	
4.0	To design Rigid and Flexible pavements.	4.1	Design of flexible and rigid pavement as per IRC codes.	a,b,g,i	
5.0	To understand highway construction, distresses in pavements and maintenance options.	5.1	Analyse the concepts of pavement failures and apply it in maintenance methods	b,d,g,i	
UNIT I - HIGHWAY PLANNING AND ALIGNMENT					(9)
Introduction to Transportation modes - Highway classification - Highway alignment and Engineering surveys for Alignment- conventional and modern methods - Master Plan - Traffic Studies - origin and destination studies.					
UNIT II - GEOMETRIC DESIGN OF HIGHWAY					(10)
Road Geometrics - Highway cross section elements - Camber - Sight Distance - Horizontal Alignment Design, Super Elevation, Extra widening, Transition curves - Design of Vertical curves.					
UNIT III - HIGHWAY MATERIALS AND CONSTRUCTION					(9)
Material requirement for pavements - Soil classification for Highway - Soil tests, CBR and Plate Load Test - Aggregate, materials testing and specifications - Bitumen, material testing and specification - Construction of Flexible and Rigid pavement.					
UNIT IV - HIGHWAY DESIGN					(8)
Pavement Analysis - Factors affecting pavement thickness - Soil - Wheel load - Temperature - Environmental factors; Flexible Pavement Design - Axle Load surveys - CBR method of Design, Rigid Pavement Design - IRC method.					
UNIT V - HIGHWAY MAINTENANCE AND DRAINAGE					(9)
Pavement Failures and Causes of Pavement failures - Pavement Management Systems - Pavement evaluation - Strengthening of pavements - Types of maintenance - Highway Drainage - Importance of highway drainage - special considerations for hill roads.					
TOTAL (L: 45) = 45 PERIODS					
TEXT BOOKS:					
1. S.K.Khanna, C.E.G.Justo, "Highway Engineering", New Chand & Bros, Roorkee, 2015.					
2. L.R.Kadiyali and N.B Lal, "Principles and Practice of Highway Engineering (Including expressways and Airport Engineering)", Khanna Publishers, New Delhi, 2013.					
REFERENCES:					
1. G.V.Rao, "Principles of Transportation and Highway Engineering", Tata McGraw Hill Co, New Delhi, 2005.					
2. ParthaChakroborthy, Animesh Das, "Principles of Transportation Engineering", Prentice-Hall of India, New Delhi, 2011.					

17CEC10 - APPLIED HYDRAULICS ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CEC04		QUESTION PATTERN : TYPE -3			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	To relate the theory and practice of problems in hydraulic engineering.	1.1	Apply their knowledge of fluid mechanics in addressing problems in open channels.	a,b,l	
2.0	To introduce various hydraulic engineering problems like open channel flows and flow characteristics	2.1	Able to identify a effective section for flow in different cross sections	b,k	
3.0	To understand the concept of hydraulic jumps and surges.	3.1	Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.	a,b,c,l	
4.0	To understand the concepts and performance characteristics of flow through turbines.	4.1	Understand the principles, working and application of turbines	a,e,g,l	
5.0	To study the classification, performance characteristics and design aspects of pumps.	5.1	Understand the principles, working and application of pumps.	a,e,l	

UNIT I - UNIFORM FLOW	(9)
Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow .	
UNIT II - GRADUALLY VARIED FLOW	(9)
Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation	
UNIT III - RAPIDLY VARIED FLOW	(9)
Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)	
UNIT IV – TURBINES	(9)
Impact of Jet on flat, curved plates, Stationary and Moving - Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic Curves of Turbines- Draft tube and cavitation.	
UNIT V – PUMPS	(9)
Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels - Savings in work done.	
TOTAL (L: 45) = 45 PERIODS	
TEXT BOOKS:	
1. Bansal.R.K "Fluid Mechanics and Hydraulic Machines", 9 th revised ed., Laxmi Publications, New Delhi, Reprint 2015.	
2. Subramanya.K "Flow in open channels", Tata McGraw Hill, New Delhi, 2000.	
3. Subramanya.K., " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.	

REFERENCES:

1. V.T.Chow, "Open Channel Hydraulics", Blackburn Press, Caldwell United States, 2009.
2. Modi P.N and Seth.S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
3. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, 12th ed., 2016



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17CEC11 - CONCRETE TECHNOLOGY					
[IS: 10262: 2009 and IS 456:2000 Code Books are to be permitted]					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CEC05			QUESTION PATTERN : TYPE -3		
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	To impart knowledge on the types and properties of cement.	1.1	Determine the properties of cement.	b,c,d,g,j,l	
2.0	To understand about properties of concrete making materials.	2.1	Find out the properties of aggregates and admixtures	b,d,e,l	
3.0	To study about concrete design mix.	3.1	Understand the IS mix design and quality control of concrete	a,b,c,d,e,f,j,l	
4.0	To study the behaviour of concrete at the fresh and hardened state.	4.1	Determine the properties of fresh and hardened concrete.	b,e,f,j,l	
5.0	To impart knowledge on the special concretes	5.1	Acquire knowledge about the application of special concretes	c,d,e,f,j,l	

UNIT I - PROPERTIES OF CEMENT	(9)
Manufacturing of Cement by wet and dry Process, Types of cement – Properties of Cement - Heat of Hydration - Test on Cement - Field Test - Laboratory Testing Methods - Fineness of cement, Consistency of cement, Specific Gravity of cement, Setting properties of cement, Soundness of cement and compressive strength of cement mortar.	
UNIT II - AGGREGATES AND ADMIXTURES	(9)
Fine aggregate and coarse aggregate - Properties and testing methods of fine aggregates - fineness modulus - Bulking of Sand - sieve analysis - Properties and testing methods of coarse aggregates - Crushing test, Abrasion test, Impact test, Specific gravity and water absorption test - mineral and chemical admixtures.	
UNIT III - MIX DESIGN AND CONCRETE PRODUCTION	(9)
Selection of materials for concrete - water cement ratio - Concrete mix design – concepts variables in proportioning – methods of mix design - Indian Standard method, Factor affecting the test results, process of manufacture of concrete- Properties of fresh concrete - workability – measurement of workability - Statistical and quality control of concrete.	
UNIT IV - STRENGTH OF CONCRETE	(9)
Strength of concrete - gain of strength with age – testing of hardened concrete - Compressive strength - Tensile strength - Flexural strength - modulus of elasticity of concrete- Stress and Strain characteristics. Introduction to NDT Techniques- Rebound hammer and Ultrasonic pulse velocity test.	
UNIT V - SPECIAL CONCRETES	(9)
Introduction to Polymer concrete, High performance concrete, High strength concrete, Fibre reinforced concrete, Light weight concrete, Ready mix concrete and pumping of concrete.	
TOTA(L: 45) = 45 PERIODS	
TEXT BOOKS:	
1. Santhakumar.A. R "Concrete Technology", Oxford University Press, New Delhi, 2006.	
2. Shetty M.S. "Concrete Technology", S. Chand & Company Ltd, New Delhi, 2010	



REFERENCES:

1. Metha P.K, "Concrete: Microstructure, properties and Materials", McGraw-Hill, New Delhi 2005.
2. Neville.N.M, "Properties of Concrete", 5th ed., Prentice-Hall of India, New Delhi, 2012.
3. IS : 12269-1987, "Specification for 53 grade OPC", BIS, New Delhi
4. IS : 383 - 2016, Coarse and Fine Aggregate - Specification, BIS, New Delhi
5. IS: 10262: 2009 "Concrete mix proportioning - Guidelines, BIS, New Delhi.
6. IS: 456-2000, "Plain and Reinforced Concrete - Code of Practice, BIS, New Delhi.



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17CEC12 - STRUCTURAL ANALYSIS – I					
		L	T	P	C
		3	2	0	4
PREREQUISITE : 17CEC07		QUESTION PATTERN : TYPE – 4			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To introduce the basic concepts of structural analysis and the classical methods for the analysis of buildings.	1.1	Analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames	a,b,c	
2.0	To analyse the structures for internal forces by theorem of three moments and slope deflection method.	2.1	Analyse the continuous beams and portal frames by slope deflection method.	a,b,c	
3.0	To analyse the structures for internal forces by Moment distribution method.	3.1	Understand the concept of moment distribution method.	a,b	
4.0	To analyse the indeterminate structures and settlement of supports	4.1	Analyse the beams and support by kani's method.	a,b	
5.0	To understand an influence lines for statically determinate and indeterminate beams.	5.1	Draw the influence lines for statically determinate and indeterminate structures	b,c	

UNIT I - PIN JOINTED FRAME	(9+6)
Degree of static and kinematic indeterminacies of plane frames - analysis of indeterminate pin-jointed frames - rigid frames (Degree of statically indeterminacy upto two) Principles of virtual work for deflections - Deflections of pin jointed plane frames and rigid frames.	
UNIT II - SLOPE DEFLECTION METHOD	(9+6)
Slope deflection method - analysis of continuous beams and portal frames (with and without sway) - bending moment and shear force diagram.	
UNIT III - MOMENT DISTRIBUTION METHOD	(9+6)
Moment distribution method - analysis of continuous beams and portal frames (with and without sway) - bending moment and shear force diagram.	
UNIT IV - ENERGY METHOD	(9+6)
Kani's Method - Analysis of Indeterminate Structures - Settlement of Supports (with and without sway)	
UNIT V - INFLUENCE LINES	(9+6)
Influence line - influence lines for bending moment and shear force, Muller Breslau's - principle, determinate and indeterminate beams.	
TOTAL (L: 45+ T:30) = 75 PERIODS	
TEXT BOOKS:	
1. Vaidyanathan, R and Perumal, P., "Comprehensive Structural Analysis," Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, 4 th ed., 2016.	
2. Subrata Chakarabarty, Sujit Kumar Roy., "Fundamentals of Structural Analysis", S.Chand & Company Ltd, New Delhi, 2012.	
REFERENCES:	
1. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", Laxmi Publications, New Delhi, 2015.	
2. S.S.Bhavikatti, "Structural Analysis" – Vol.I& II, Vikas Publishing Pvt Ltd., New Delhi, 4 th ed., 2013.	
3. Wang, C.K., "Analysis of Indeterminate Structures", Tata McGraw-Hill, New Delhi, 2000.	
4. Negi, L.S. and Jangid, R.S., "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2004.	




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17CEC13 - DESIGN OF REINFORCED CONCRETE ELEMENTS (IS 456 : 2000 and SP 16 code books are to be permitted)					
		L	T	P	C
		3	2	0	4
PREREQUISITE : NIL			QUESTION PATTERN : TYPE- 4		
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To understand the concept of working stress and limit state methods.	1.1	Identify the basic concepts and methods in the design of reinforced concrete elements.		b,I
2.0	To gain knowledge of limit state design of beam	2.1	Design the beam using IS code of practice.		a,b,I
3.0	To understand the design concepts in slab and staircase	3.1	Apply the concepts in design of slab and staircase.		a,b,I
4.0	To understand the concepts in the design of RC Column.	4.1	Design of RC columns of any cross section with different end conditions.		a,b,I
5.0	To give the knowledge in the concept of RC footings.	5.1	Select and design of RC footing of different cross section under various site conditions.		a,b,h,I

UNIT I DESIGN PHILOSOPHY	(6+6)
Concept of Elastic method, ultimate load method and limit state method - Advantages of Limit State Method over other methods - Design codes and specification - Limit State philosophy as detailed in IS code.	
UNIT II DESIGN OF BEAM	(12+6)
Analysis and design of singly and doubly reinforced rectangular beam and Flanged beams (T- Beams only) - Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined Bending, Shear and Torsion.	
UNIT III DESIGN OF SLAB AND STAIRCASE	(9+6)
Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams - Two way slab - Design of simply supported and continuous slabs using IS code coefficients - Types of Staircases - Design of dog-legged Staircase.	
UNIT IV DESIGN OF COLUMN	(9+6)
Types of columns – Braced and unbraced columns - Design of short rectangular and circular columns for axial, uniaxial and biaxial bending.	
UNIT V DESIGN OF FOOTING	(9+6)
Design of wall footing - Design of axially and eccentrically loaded rectangular pad and sloped footings - Design of combined rectangular footing for two columns only.	
TOTAL (L: 45+ T:30) = 75 PERIODS	
TEXT BOOKS:	
1. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2007.	
2. Varghese P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd., New Delhi, 2002.	
3. N. Krishna Raju, "Design of Reinforced Concrete Structures (IS: 456-2000)", 4 th ed., 2016.	

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REFERENCES:

1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2014
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 3rd ed., 2009
3. Subramanian, N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
4. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
5. SP:16, "Design Aids for Reinforced Concrete", Bureau of Indian Standards, New Delhi, 2007

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17CEC14 - FOUNDATION ENGINEERING (IS 6403 code book is to be permitted)					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 17CEC08		QUESTION PATTERN : TYPE- 4			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes		Related Program outcomes	
		The students will be able to			
1.0	To impart knowledge for plan and execute a detail site investigation programme	1.1	Understand the importance of soil investigation in various civil Engineering projects	b,e	
2.0	To explain the concepts related to bearing capacity and settlement for various types of soils and loading conditions.	2.1	Estimate bearing capacity incorporating IS codal provisions.	a,b,l	
3.0	To select geotechnical design parameters and type of foundations	3.1	Do proper foundation proportioning for any kind of shallow foundation system and get exposure in foundation analysis.	a,d,j,l	
4.0	To discuss different types of pile foundation and its capacity	4.1	Estimate pile and pile group capacity, group efficiency for various types of soils	a,b,c,e,g,l	
5.0	To study various earth pressure theories	5.1	Analysis earth retaining structures for various soil conditions	a,g,l	

UNIT I - SOIL INVESTIGATION AND CHOICE OF FOUNDATION	(7)
Methods of Soil Exploration - Boring - Sampling - Disturbed and undisturbed Sampling - Sampling techniques - Bore log and soil investigation report - Function and requirements of good foundation - Choice of foundation based on soil conditions.	
UNIT II - BEARING CAPACITY AND SETTLEMENT	(9)
Location and depth of foundations - Bearing capacity of shallow foundations on homogeneous deposit - Terzaghi's Theory - IS Code method - Problems - Field tests (SPT and SCPT) - Factors influencing Bearing Capacity - Settlement of foundations - Components of settlement - Allowable and maximum differential settlement.	
UNIT III - SHALLOW FOUNDATION	(9)
Types of footings - Contact pressure distribution: isolated footing - combined footings - proportioning - Mat foundation - Types and applications - Floating foundation.	
UNIT IV - PILE FOUNDATION	(9)
Need for deep foundations -Types of piles - classification of piles - Load carrying capacity of piles in granular and cohesive soils - Static and Dynamic formulae - Pile carrying capacity by field tests - Pile load test - Group Capacity - Settlement of Pile groups - Negative skin friction.	
UNIT V - STABILITY OF SLOPES AND EARTH PRESSURE	(11)
Slopes - Infinite and finite slopes - types of failure - causes of failure - Procedure for slip circle method - Earth pressure in soils: active and passive states - Lateral earth pressure - Rankine's theory - Cullman's Graphical method - Stabilization of soil using various methods.	
TOTAL (L:45) = 45 PERIODS	
TEXT BOOKS:	
1. Dr. K. R. Arora., "Soil Mechanics and Foundation Engineering", Standard Publisher, New Delhi, 2017.	
2. Venkataramalah.C, "Geotechnical Engineering", New Age International Ltd., New Delhi, 2008.	



REFERENCES:

1. Varghese P.C., "Foundation Engineering", Prentice Hall of India, 2012.
2. Alam Singh, "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2012.
3. Punmia, B. C., "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, 16th ed., 2005.
4. Gopal Ranjan and Rao, "Basic and Applied Soil Mechanics", New Age International Pvt Ltd, New Delhi, 2002
5. IS 6403 - 1981, "Code of Practice for Determination of Bearing Capacity of Shallow Foundation", Bureau of Indian Standards, New Delhi.




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17CEC15 - WATER RESOURCES AND IRRIGATION ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		QUESTION PATTERN : TYPE-3			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To emphasize the need for water resources planning	1.1	Get exposure about the developments of water resources.	g,k	
2.0	To emphasis the need and importance of Irrigation	2.1	Assess the irrigation needs of crops	c,e,g,i	
3.0	To impart required knowledge on hydraulic design of different structures and the concept of maintenance	3.1	Study about different types of structures for irrigation	c,e,l	
4.0	To provide training on design of impounding structures	4.1	Implement various types of irrigation methods	c,d,g	
5.0	To realize the importance of participatory irrigation management	5.1	Plan for water management and minimize irrigation water losses	g,k	
UNIT I - INTRODUCTION OF WATER RESOURCES					(9)
Water resources survey - Description of water resources planning - Estimation of water requirements for irrigation and drinking - Single and multipurpose reservoir. Flood - levees and flood walls. Concept of basin as a unit for development - Water budget - Conjunctive use of surface and ground water.					
UNIT II - INTRODUCTION OF IRRIGATION ENGINEERING					(9)
Irrigation - Need and mode of irrigation - Merits and demerits of irrigation - Crop and crop seasons -consumptive use of water - Duty - Factors affecting duty - Irrigation efficiencies - Planning and Development of irrigation projects.					
UNIT III - CANAL IRRIGATION					(9)
Gravity dam - Diversion Head works - Alignment of canals - Classification of canals - Canal drops - Cross drainage works - Canal Head works - Canal regulators - River Training works.					
UNIT IV - IRRIGATION METHODS					(9)
Lift irrigation - Canal irrigation - Tank irrigation - Flooding methods - Sprinkler irrigation - Drip irrigation Well irrigation - Irrigation methods: Surface and Sub-Surface and Micro Irrigation - Merits and demerits					
UNIT V - IRRIGATION WATER MANAGEMENT					(9)
Need for optimization of water use - Minimising irrigation water losses - On farm development works -Participatory irrigation management - Water users associations.					
TOTAL (L:45) = 45 PERIODS					
TEXT BOOKS:					
1. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23 rd Revised Edition, New Delhi, 2009					
2. Punmia B.C. and Pande B.B .Lal Irrigation and Water Power Engineering, Laxmi Publishing, New Delhi, 2007					
3. Michael, A.M, Irrigation Theory and Practical, Vikas Publishing Pvt Ltd, 2006					
4. Gupta, B.L, and Amir Gupta, "Irrigation Engineering", Satya Prahesan, New Delhi, 2007					
REFERENCES:					
1. Dilip Kumar Majumdar, "Irrigation Water Management (Principles and Practices)", Prentice Hall of India (P), Ltd, 2000					
2. Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co. New Delhi, 1999					
3. Sharma R.K, "Irrigation Engineering", S.Chand and Co. 2007.					

17CEC16 - STRUCTURAL ANALYSIS – II					
		L	T	P	C
		3	2	0	4
PREREQUISITE : 17CEC12			QUESTION PATTERN : TYPE -4		
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	To analyze the three hinged, two hinged and fixed arches.	1.1	Analyze of three hinged, two hinged and fixed arches	a,b	
2.0	To analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.	2.1	Analysis simple determinate and indeterminate beams, frames and trusses using flexibility matrix method	a,b,d	
3.0	To formulate the element stiffness matrix and assemble the structure matrix for solving indeterminate problems	3.1	Analysis simple determinate and indeterminate beams, frames and trusses using stiffness matrix method.	a,b,d	
4.0	To analyse the suspension bridges and space truss	4.1	Determine the member forces in suspension bridges and space truss	a,d,f	
5.0	To understand the basics of finite element method and its application to structural analysis.	5.1	Explain the basic concepts in finite element method	a,b	

UNIT I - ARCHES	(9+6)
Arches as structural forms - Types of arches - Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches - Settlement and temperature effects.	
UNIT II - FLEXIBILITY METHOD	(9+6)
Concept of flexibility matrix – determinate Vs indeterminate - Analysis of indeterminate pin-jointed plane frames, analysis of continuous beams, rigid jointed plane frames.	
UNIT III - STIFFNESS METHOD	(9+6)
Stiffness matrix for beam element - analysis of continuous beams - plane frames and pin jointed plane frames.	
UNIT IV - SPACE AND CABLE STRUCTURES	(9+6)
Analysis of Space trusses using method of tension coefficients - Beams curved in plan - Suspension cables - suspension bridges with two and three hinged stiffening girders.	
UNIT V - INTRODUCTION OF FINITE ELEMENT METHOD	(9+6)
Introduction - Discretization of a structure - Displacement functions - Truss element - Beam element - Plane stress and plane strain - Triangular elements.	
TOTAL (L: 45 + T:30) = 75 PERIODS	
TEXT BOOKS:	
1. Vaidyanathan, R and Perumal, P. "Comprehensive Structural Analysis," Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, 4 th ed., 2016.	
2. V.N.Vazirani and M.M.Ratwani, "Analysis of Structures" Volume I and II, Khanna Publishers, New Delhi, 2015.	
3. S.S.Bhavikatti, "Structural Analysis" - Vol. I & II, Vikas Publishing Pvt Ltd., New Delhi, 4 th ed., 2013.	
REFERENCES:	
1. R.L.Jindal, "Indeterminate Structures", Tata Mc Graw Hill Publishing House, 1996.	
2. Negi L.S, "Theory & Problems in Structural Analysis", Tata McGraw Hill Publishing House, 2004.	
3. G.S.Pandit & Gupta S.P. Structural Analysis (A Matrix Approach), Tata McGraw Hill, Publishing Ltd, 2008.	



17CEC17 - DESIGN OF STEEL STRUCTURES [IS 800-2007 and Steel Tables are to be permitted]						
			L	T	P	C
			3	2	0	4
PREREQUISITE : 17CEC03			QUESTION PATTERN : TYPE -4			
COURSE OBJECTIVES AND OUTCOMES						
Course Objectives		Course Outcomes			Related Program outcomes	
		The students will be able to				
1.0	To study the design of bolted and welded connections.	1.1	Analyse the behaviour of bolted and welded connecting and design them,	a,b,l		
2.0	To provide knowledge on design of tension members.	2.1	Know the concept of design of tension members	a,b,l		
3.0	To get familiar with compression member design.	3.1	Design compression members using simple and built-up sections.	a,b,g,l		
4.0	To study the behavior of flexural members and design the beams.	4.1	Design various types of flexural members.	a,b,g,l		
5.0	To understand the design of industrial buildings.	5.1	Design industrial structures and their components.	g,j,l		

UNIT I - INTRODUCTION	(9+6)
Properties of steel - Structural steel sections - Limit State Design Concepts - Loads on Structures - Connections using welding and bolting - Design of bolted and welded joints - Eccentric connections - Efficiency of joints	
UNIT II - TENSION MEMBERS	(9+6)
Types of sections - Net area - Net effective sections for angles and Tee in tension - Design of connections in tension members - Use of lug angles - Design of tension splice - Concept of shear lag.	
UNIT III - COMPRESSION MEMBERS	(9+6)
Types of compression members - Theory of columns - Basics of current codal provision for compression member design - Slenderness ratio - Design of simple and built up members - Design of laced and battened type columns - Design of column bases - Gusseted base - Anchor Bolts.	
UNIT IV - BEAM	(9+6)
Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Design of plate girders - Intermediate and bearing stiffeners - Flange and web splices.	
UNIT V - ROOF TRUSS AND INDUSTRIAL BUILDING	(9+6)
Roof trusses - Roof and side coverings - Introduction of Pre-Engineered Buildings - Design of purlins and elements of truss; end bearing - Design of gantry girder.	
TOTAL (L: 45 + T:30) = 75 PERIODS	
TEXT BOOKS:	
1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.	
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt.	

3. Shiyekar, M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd ed., 2013.
4. Bhavikatti S.S, "Design of Steel Structures", IK International Publishing House Pvt. Ltd., New Delhi 2010


REFERENCES:

1. Dr. L. S. Jayagopal, Dr. D. Tensing, "Design of Steel Structures", Vikas Publishing House Pvt. Ltd., 2015
2. Narayanan.R "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
3. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2009
4. Shah.V.L and Veena Gore, "Limit State Design of Steel Structures", IS 800-2007 Structures Publications, 2012.
5. IS 800:2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007



17CEC18 - DESIGN OF REINFORCED CONCRETE STRUCTURES [IS 456, SP 16 and IS 3370 Code Books are to be permitted]				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 17CEC13		QUESTION PATTERN : TYPE -4		
COURSE OBJECTIVES AND OUTCOMES				
Course Objectives		Course Outcomes The students will be able to		Related Program outcomes
1.0	To understand the basic concepts in the behavior and design of earth retaining structures.	1.1	Design counterfort and cantilever retaining walls.	a,b,c,g,l
2.0	To provide knowledge on design of various components in the water tank.	2.1	Design underground and overhead R.C water tanks for the given capacity	a,c,l
3.0	To provide knowledge on design of flat slab and raft foundations.	3.1	Design flat slabs as per IS standards.	a,b,c,g,l
4.0	To explain the basic concepts about the yield line theory for the analysis and design of slab.	4.1	Analyze and design various types of slabs using yield line theory.	a,b,c,g,l
5.0	To design the slender column and industrial structures	5.1	Design columns for axial, uniaxial and biaxial bending and industrial structures.	a,b,c,d,g,l
UNIT I - RETAINING WALLS				(9)
Functions of a Retaining Wall - Design of Cantilever and Counterfort Retaining walls				
UNIT II - WATER TANKS				(9)
Design principles of elevated overhead water tank - Design of rectangular underground water tank - Design of circular overhead water tank				
UNIT III - FLAT SLABS				(9)
Design of flat slabs (Problems) - Principles of design of Raft foundation, box culvert and road bridges				
UNIT IV - YIELD LINE THEORY				(9)
Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment - Application of virtual work method - square, rectangular, circular and triangular slabs - Design problems				
UNIT V - SLENDER COLUMN AND INDUSTRIAL STRUCTURES				(9)
Design of Slender columns - Design for Uniaxial and Biaxial bending using Column Curves (Problems) - Bunkers - Basic Concepts - Silos - Design Principles				
TOTAL (L: 45) = 45 PERIODS				
TEXT BOOKS:				
1. Krishnaraju. N., "Design of reinforced Concrete Structures", CBS Publishers and Distributors Pvt Ltd, 4 th ed., 2015.				
2. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.				
3. Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.				
REFERENCES:				
1. Ram Chandra.N and Virendra Gehlot, "Limit State Design", Standard Book House, 2004.				
2. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012				
3. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.				
4. IS 456:2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2007				
5. SP 16:1980, Design Aids for Reinforced Concrete, Bureau of Indian Standards, New Delhi.				
6. IS 3370 (Part I & II):2009, Concrete Structures for Storage of Liquids - Code of Practice, Bureau of Indian Standards, New Delhi.				




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17CEC19 – ENVIRONMENTAL ENGINEERING					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL			QUESTION PATTERN : TYPE -4		
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			Related Program outcomes
		The students will be able to			
1.0	To understand the principles of water supply system and planning the sources	1.1	Recognize the water supply system, water sources and water quality characteristics and standards	c,g	
2.0	To get knowledge in treatment of water.	2.1	Design various water treatment units.	a,e,i	
3.0	To grasp the principles of collection, conveyance and treatment of wastewater.	3.1	Design the various primary treatment units for wastewater	b,g	
4.0	To recognize the different primary and secondary treatment techniques of wastewater	4.1	Design and choose the various secondary treatment units for wastewater	b,e,g	
5.0	To gain knowledge about solid waste disposal	5.1	Select suitable treatment units for disposal of sewage and sludge.	b,f	

UNIT I - SOURCES AND QUALITY OF WATER	(9)
Public Water supply system –Intakes- Channels and pipes for conveying water - Planning, Objectives, Design period, Population forecasting - water demand –Sources of water – Surface and Ground water – Characteristics of water	
UNIT II - WATER TREATMENT	(11)
Water treatment Objectives – Unit operations and processes in surface water treatment - Principles, functions and design of flash mixers, flocculators, sedimentation tanks and sand filters – Aeration – iron and manganese removal, defluoridation.	
UNIT III - PRIMARY WASTE WATER TREATMENT	(9)
Characteristics of sewage, Primary treatment: Principles, functions and design of screen, grit chambers and primary sedimentation tanks operation and maintenance aspects.	
UNIT IV - SECONDARY WASTE WATER TREATMENT	(9)
Activated Sludge Process and Trickling filter (no design); Other treatment methods - oxidation ditches, UASB -Waste Stabilization Ponds - Anaerobic Stabilization units - Septic tanks.	
UNIT V - DISPOSAL OF SEWAGE AND SLUDGE	(7)
Dilution – Self-purification of surface water bodies – Oxygen sag curve – disposal to lakes and sea, Land disposal – Sewage farming - characteristics of Sludge -Thickening – Sludge digestion – Sludge disposal - Drying beds – Conditioning and Dewatering.	
LIST OF EXPERIMENTS:	
1. Determination of Turbidity by using Nephelometer	
2. Measurement of pH and conductivity of water sample	
3. Determination of Hardness by EDTA method	
4. Determination of Alkalinity	
5. Determination of Acidity in water	
6. Determination of Chlorides	
7. Determination of Residual chlorine	

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8. Determination of Optimum Coagulant by Jar test
9. Determination of Total, Dissolved and Suspended solids
10. Determination of Available chlorine in bleaching powder
11. Determination of Dissolved Oxygen and BOD for the given sample
12. Determination of COD for given sample

TOTAL (L:45 + P:30)= 75 PERIODS

TEXT BOOKS:

1. Garg, S.K., "Environmental Engineering", Vol.I and II, Khanna Publishers, New Delhi, 2005.
2. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2010.
3. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. Government of India, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, New Delhi, 2013.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning", Design and Operation, Prentice Hall of India Private Limited, New Delhi, 2006.
3. George Tchobanoglous, Franklin Louis Burton, H. David Stensel, Metcalf & Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw-Hill Edition, 4th ed., New Delhi, 2009.

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D.N. Rao

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17CEC20 – ESTIMATING, COSTING AND VALUATION

		L	T	P	C
		3	0	2	4
PREREQUISITE : 17CEP07		QUESTION PATTERN : TYPE-4			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To impart the knowledge on basic concepts related to estimate preparation	1.1	Prepare the estimate corresponding to the required specification	a,b,f,h,i	
2.0	To analyse the rate of a work item according to the specification	2.1	Arrive rates of various work items of civil Engineering works and familiarized with tendering	b, c,e,g, i,k,l	
3.0	To understand the concepts behind the preparation of estimate of the various civil engineering works.	3.1	Prepare bills of quantities in construction works.	a,d,f,j,l	
4.0	To study the rate analysis, valuation of properties and preparation of reports for estimation of various items.	4.1	Predict the value of properties considering various influencing factors.	b,e,f,j	
5.0	To understand the terminologies and concepts behind the valuation of properties, depreciation and time value of money	5.1	Get familiarized with report process.	a,j,l	

UNIT I - INTRODUCTION TO ESTIMATES AND SPECIFICATIONS	(9)
General introduction to Quantity surveying - purpose of estimates - Types of estimates, various items to be included in estimates - Principles in selecting units of measurement for items, various units and modes of measurement for different trades - I.S. 1200, Specifications - purpose and basic principles of general and detailed specifications - detailed specifications for various items of work.	
UNIT II - RATE ANALYSIS AND TENDERS	(10)
Analysis of rates, factors affecting the cost of materials, labour. Taskwork, schedule as basis of labour costs. Plants and equipment - hour costs based on total costs and outputs - Overhead charges, rates for various items of construction of civil engineering works. Standard schedule of rate, price escalation.	
UNIT III - ESTIMATION OF CIVIL ENGINEERING WORKS	(9)
Reading and interpretation of architectural and structural drawings - Detailed estimate of masonry buildings, R.C.C works, Preparation of schedule for steel as reinforcement - Preparation of bills of quantities - Approximate estimates, purpose, various methods used for buildings and other civil engineering works such as culvert and road projects - Estimating of irrigation works – aqueduct, siphon.	
UNIT IV – VALUATION	(8)
Principles of valuation, definition of value, price and cost - Attributes of value, Different types of values- Valuer and his duties, purpose of valuation and its function. Factors affecting the valuation of properties - free hold and leasehold properties, different types of lease - Methods of valuation - Forms of rent, different types of rent - carpet area basis, unit basis, cubic content basis - Sinking fund, Depreciation	
UNIT V - REPORT PREPARATION	(9)
Principles for report preparation - Report on estimate of residential building - Culvert - Roads - Water supply and sanitary installations - Tube wells - Open wells.	



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LIST OF EXPERIMENTS:

1. Rate analysis for earth work, PCC, RCC, Brick work, plastering and steel fabrication
2. Calculation of quantities and prepare the estimate for load bearing structure (Residential)
3. Calculation of quantities and prepare the estimate for framed structure (Commercial)
4. Prepare the bar-bending schedule for footing, column, plinth / roof beam and slab

TOTAL (L: 45+ P:30)= 75 PERIODS**TEXT BOOKS:**

1. Birdie .G.S, "Text Book on Estimating and Costing", Dhanpat Rai Publishing Company, New Delhi, 2014.
2. Dutta, B.N., "Estimating and Costing in Civil Engineering (Theory and Practice)", UBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016
3. Chakraborti .M, "Estimating Costing, Specification and Valuation in Civil Engineering", Chakraborti Publishers, , 2010.

REFERENCES:

1. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2014
2. Jogleka .P.T, "Practical Information for Quantity Surveyors", Mrs. Mandakini Joglekar, Pune, 1992.
3. Rangwala .S.C., "Estimating, Costing and Valuation", Charotar Publishing House, Anand, 2017.



17CEC21 - CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICE

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

QUESTION PATTERN : TYPE-3

COURSE OBJECTIVES AND OUTCOMES

Course Objectives		Course Outcomes The students will be able to.		Related Program outcomes
1.0	To aware of the various construction techniques and practices needed for different types of construction activities	1.1	Know the different construction techniques and structural systems	c,e,l
2.0	To get knowledge about the various construction procedures for sub to super structure	2.1	Apply the various construction practices in the field.	c,e,l
3.0	To get idea for selection of equipment's for earthwork	3.1	Predict the equipment for different types of work	b,e,l
4.0	To study the equipment needed for construction of various types of structures from foundation to super structure.	4.1	Plan the requirements for substructure construction.	c,g,l
5.0	To know the different construction of structures and erection works.	5.1	Know the methods and techniques involved in the construction of various types of super structures	b,e,l

UNIT I - CONSTRUCTION TECHNIQUES

(9)

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism - floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials - responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Energy efficient buildings for various zones.

UNIT II - CONSTRUCTION PRACTICES

(9)

Specifications, details and sequence of activities and construction co-ordination - Site Clearance - Marking - Earthwork - masonry - stone masonry - Bond in masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - frames - braced domes - laying brick - weather and water proof - roof finishes - acoustic and fire protection.

UNIT III - CONSTRUCTION EQUIPMENT

(9)

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end loaders, earth movers - Equipment for foundation and pile driving - Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures - types of cranes - Equipment for dredging, trenching, tunneling.

UNIT IV - SUB STRUCTURE CONSTRUCTION

(9)

Techniques of Box jacking - Pipe Jacking - under water construction of diaphragm walls and basement-Tunneling techniques - Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation

UNIT V - SUPER STRUCTURE CONSTRUCTION

(9)

Launching girders, bridge decks, off shore platforms - special forms for shells - techniques for heavy decks - in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space trusses - Fabricated panels and structures - production, transporting and erection of structures.

TOTAL L: 45 T: 45 PERIODS



TEXT BOOKS:

1. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.
2. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
3. Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2013

REFERENCES:

1. Peurfoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 2001.
2. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
4. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi, 1983.

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17CEX13 – REPAIR AND REHABILITATION OF STRUCTURES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL		QUESTION PATTERN : TYPE-3			
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes The students will be able to			Related Program outcomes
1.0	To get the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.	1.1	Identify the maintenance and assessment method of distressed structures		c,d
2.0	To Recognize deterioration of concrete buildings.	2.1	Understand the strength and durability properties ,their effects due to climate and temperature.		b,c,e
3.0	To Know Deficiencies in various forms of steel constructions.	3.1	Know about recent development in concrete		c,e,l
4.0	To Aware of Strengthening techniques for prevailing structures.	4.1	Learn the techniques for repair and protection methods		c,d,e,l
5.0	To Compare of verities of rehabilitation techniques according to requirement.	5.1	Study about repair, rehabilitation and retrofitting of structures and demolition methods.		b,c,g,l


UNIT I - MAINTENANCE AND REPAIR STRATEGIES	(9)
Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration	
UNIT II - SERVICEABILITY AND DURABILITY OF CONCRETE	(11)
Concrete properties - strength, permeability, thermal properties and cracking - Effects due to climate, temperature, chemicals, corrosion – design and construction errors - Effects of cover thickness and cracking & IS Code Book for Cover thickness.	
UNIT III - MATERIALS FOR REPAIR	(9)
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.	
UNIT IV - TECHNIQUES FOR REPAIR AND DEMOLITION	(8)
Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning, Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidate structures - case studies.	
UNIT V - REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES	(8)
Repairs to overcome low member strength, Test on Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Guha, P.K, "Maintenance and Repairs of Buildings", New Central Book Agency (P) Ltd, Calcutta, 2011
2. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.

REFERENCES:

1. M.S.Shetty, "Concrete Technology" Theory and Practice, S.Chand and Company, New Delhi, 2010.
2. Santhakumar, A.R., "Training Course notes on Damage Assessment and repair in Low Cost Housing" "RHDC-NBO" Anna University, 1992.
3. Raikar, R.N., Learning from failures - Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Lakshmiopathy, M. Lecture Notes of Workshop on "Repairs and Rehabilitation of Structures", 29th - 30th October 1999.


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22STB01 - DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURAL SYSTEMS
(IS 456 -2000 code book is to be permitted)

L	T	P	C
3	1	0	4

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To make familiar to students in Design standards. which helps them,	1.1	The students will be able to calculate the deflection and crack width in the flexural members
2.0	To acquire knowledge about the design of special reinforced concrete elements.	2.1	The students will be able to formulate the procedure to design the slender column, corbels and spandrel beams
3.0	To know about the design of the flat slabs and grid floors	3.1	The students will be able to analysis and design the flat slabs and grid floors
4.0	To learn the knowledge about inelastic behavior of concrete structures.	4.1	The students will be able to evaluate the inelastic behavior of concrete structures
5.0	To impart knowledge on design of RC wall and concepts of ductility	5.1	The students will be able to design RC walls and observe the concepts of ductile detailing

UNIT I - DESIGN CONCEPTS AND LIMIT STATE OF SERVICEABILITY	(12+3)
Limit state method - Design of beams - Deflection - Calculation of short term deflection and long term deflection - Limits on deflection. Cracking - causes of cracking - Factors influencing crack width - Mechanism of flexural cracking - Calculation of crack width by IS 456.	
UNIT II - DESIGN OF SPECIAL R.C.ELEMENTS	(9+3)
Design of Slender Column - Design of corbels - Strut and tie method - Design of simply supported and continuous deep beams - Design of Spandrel beams	
UNIT III - DESIGN OF FLAT SLABS AND YIELD LINE THEORY	(9+3)
Design of flat slabs (IS method) - Check for shear - Yield line theory and Hiller borgs strip method of design of slabs - Analysis and design of grid floors as per IS 456	
UNIT IV - INELASTIC BEHAVIOUR OF CONCRETE STRUCTURES	(9+3)
Inelastic analysis of RC beams - Moment- Rotation curves - moment redistribution - Concept of plastic hinges - Baker's method of plastic design	
UNIT V - DESIGN OF RC WALL AND DUCTILE DETAILING	(6+3)
Design of RC wall - Concepts and Detailing for ductility - Concrete cover - Fire resistance of structural members - Design of cast-in-situ joints in frames	
TOTAL (L:45, T: 15) : 60 PERIODS	

REFERENCES:

1. Unnikrishna Pillai and Devdas Menon, "Reinforced concrete Design", 4th Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2021.
2. Krishnaraju, N. "Advanced Reinforced Concrete Design", 3rd Edition., CBS Publishers and Distributors, Delhi, 2016
3. Subramanian N., "Design of Reinforced Concrete Structures", 1st Edition, Oxford University Press, 2014.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, 2nd Edition, 2007.
5. IS 456 -2000, "Plain and Reinforced Concrete - Code of Practice" 4th revision, Bureau of Indian Standards, New Delhi.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2	2	3	2	3	2	3	3
2	3	2	3	2	3	3	2	3
3	3	2	3	3	3	3	2	3
4	2	2	2	2	3	2	2	3
5	3	2	3	3	3	3	3	3
CO (W.A)	2.6	2	2.8	2.4	3	2.6	2.4	3



22STB02 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING
(IS 1893:2002, IS 13920:2016 & IS 4326:1993 codes are to be permitted)

L	T	P	C
3	0	0	3

sPRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To expose the students the principles and methods of dynamic analysis of structures.	1.1	The students will be able to do vibration analysis of system / structures with single degree of freedom and can explain the method of damping systems
2.0	To study the analysis procedure for calculating the response of MDOF systems.	2.1	The students will be able to do the dynamic analysis of system /structures with Multi degrees of freedom under free and forced vibration
3.0	To Educate the dynamic analysis of continuous systems using virtual work method	3.1	The students will be able to derive a mathematical model of continuous system and do a dynamic analysis under free and forced vibration
4.0	To study the effects of earthquake, analysis and design of Earthquake resistant design of structures	4.1	The students will be able to explain the causes and effect of earthquake
5.0	To obtain knowledge on design an earthquake resistant RC and masonry structure	5.1	The students will be able to design masonry and RC structures to the earthquake forces as per there commendations of IS codes of practice

UNIT I - PRINCIPLES OF VIBRATION ANALYSIS

(9)

Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Evaluation of damping, Transmissibility, vibration control, Tuned mass damper

UNIT II - DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS

(9)

Mathematical models of two degree of freedom systems and multi degree of freedom systems, free and forced vibrations of two degree and multi degree of freedom systems, normal modes of vibration, applications. Orthogonality of normal modes, free and forced vibrations of multi degree of freedom systems, Mode superposition technique, Applications.

UNIT III - DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS

(9)

Mathematical models of continuous systems, Free and forced vibration of continuous systems, Rayleigh - Ritz method - Formulation using Conservation of Energy - Formulation using Virtual Work, Applications.

UNIT IV - EARTHQUAKE GROUND MOTION AND ITS EFFECTS ON STRUCTURES

(9)

Engineering Seismology - Seismotectonics and Seismic zoning of India, Plate tectonics, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation. Effect of Earthquake on Different Types of Structures - Lessons Learnt

From Past Earthquakes - Evaluation of Earthquake Forces as per codal provisions - Response Spectra, Design Spectra	
UNIT V - EARTHQUAKE RESISTANT DESIGN OF MASONRY AND RC STRUCTURES	(9)
Structural Systems - Types of Buildings - Causes of damage - Planning Considerations - effect of material of construction on performance of structures - Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design of Masonry Buildings and R.C.C. Buildings. Design consideration - Rigid Frames - Shear walls - Capacity based Design and detailing	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:
<ol style="list-style-type: none"> 1. Anil K.Chopra, Dynamics of Structures, 5th Edition, Pearson Education, 2017. 2. Paulay.T and Priestley M.J.N., "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 2013. 3. Mario Paz, "Structural Dynamics - Theory and Computation", Kluwer Academic Publishers, 5th Edition, 2006. 4. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2009. 5. Duggal S K, "Earthquake Resistant Design of Structures", Oxford University Press, 2007. 6. IS 1893:2002 (Part -1), "Criteria for Earthquake Resistant Design of Structures", Bureau of Indian Standards, New Delhi 7. IS 13920- 2008, "Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice", Bureau of Indian Standards, New Delhi 8. IS 4326 : 1993, "Earthquake Resistant Design and Construction of Buildings - Code of Practice", Second Revision, Bureau of Indian Standards, New Delhi.

Mapping of COs with POs / PSOs								
COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	3	3	2	3	2	3
2	3	2	3	3	2	3	3	3
3	2	1	2	2	2	3	2	3
4			2	2	3	2	2	2
5	3	2	3	3	3	3	3	3
CO (W.A)	2.75	1.75	2.6	2.6	2.4	2.8	2.4	2.8

22STB03 - ADVANCED CONCRETE TECHNOLOGY
(IS 456 & IS 10262: 2019 codes are to be permitted)

L	T	P	C
3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To study the properties of materials, tests, admixtures for concrete and concreting under special circumstances.	1.1	The students will be able to develop knowledge on various materials needed for concrete manufacture
2.0	To acquire knowledge about mix design of concrete by various methods	2.1	The students will be able to apply the rules to do mix designs for concrete by various methods
3.0	To identify different tests for identifying the properties of concrete	3.1	The students will be able to explain different tests for identifying the properties of concrete
4.0	To gain knowledge about the types of special concrete	4.1	The students will be able to apply the usage of special concretes
5.0	To learn about the durability and quality control on concrete	5.1	The students will be able to perform tests for permeability and durability properties.

UNIT I - CONCRETE MAKING MATERIALS	(9)
Aggregates - classification - IS Specifications - Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates - Cement, Grade of cement, Chemical composition, Hydration of cement, Structure of hydrated cement, special cements - Water - Chemical admixtures - Mineral admixtures.	
UNIT II - MIX DESIGN	(9)
Principles of Concrete Mix Design - Factors in the choice of mix proportions - Mix design methods - A.C. Method - I.S Method - DOE Method - Design of High strength concrete Design of Self Compacting Concrete by using EFNARC Specifications - Design of concrete mix using mineral admixtures - Design mix for pump ability and effect of super plasticizers in water reduction.	
UNIT III - TESTING ON CONCRETE	(9)
Workability - Compression - Tension - Flexure - Bond strength - Factors affecting the results - Accelerated strength results - Stress strain characteristics - Modulus of Elasticity - In situ strength determination - Variation in results - Distribution of strength - Standard deviation - Nondestructive tests - Microstructure analysis of Concrete	
UNIT IV - SPECIAL CONCRETES	(9)
Method of Manufacture, properties and applications - Lightweight concrete-Aerated concrete - No fines concrete - Heavy weight concrete - High Strength Concrete - High Performance Concrete - Polymer Concrete - Steel fiber Reinforced Concrete - Ferrocement Concrete - Vaccum Concrete - Shotcrete - Concrete using waste material - Ready Mixed Concrete – Self compacting concrete - Geopolymer concrete.	

UNIT V - DURABILITY OF CONCRETE	(9)
Permeability - chemical attack - sulphate attack - Quality of water - marine conditions - Methods to improve durability - Thermal properties of concrete - fire resistance - Mass Concrete - Formwork - Structural Concrete Block Masonry - Quality Control of Concrete Construction.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:

1. A.M. Neville, "Properties of Concrete", Prentice Hall, London, 2012
2. Santhakumar A.R., "Concrete Technology", Oxford University Press, New Delhi, 2006.
3. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company Ltd. Delhi, 2018
4. Gambhir.M.L., "Concrete Technology", 5th Edition, McGraw Hill Education, New Delhi 2017.

Mapping of COs with POs / PSOs								
COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1			3		2	2	2	3
2	3	3	2		3	3	2	3
3	2	2			2	2	3	3
4	2		3	2	2	2		3
5	2	2	2	3	3	3	2	3
CO (W.A)	2.25	2.33	2.5	2.5	2.4	2.4	2.25	3

Gambhir M.L.

22STB05 - ADVANCED DESIGN OF STEEL STRUCTURES					
(IS 800: 2007, IS 801, IS 811, IS 875 Part 3, IS 804, IS 805 & SP-06 are to be permitted)					
		L	T	P	C
		3	1	0	4
PRE REQUISITE : NIL					
Course Objectives		Course Outcomes			
		The students will be able to			
1.0	To study the analysis and design of industrial buildings and Gable column and Gable wind girder	1.1	Analyze and design industrial structures such as trusses and portal frames subjected to wind and seismic forces		
2.0	To gain knowledge about the design of connections.	2.1	Design different types of steel connections such as welded and bolted flexible as well as moment resisting connections		
3.0	To study of plastic analysis of structures.	3.1	Apply the knowledge of plastic analysis in steel design		
4.0	To learn the analysis and design of steel towers	4.1	Design the special structures such as steel water tank and chimney, Silo and Towers		
5.0	To acquire knowledge about the design of light gauge steel structures	5.1	Evaluate the behaviour and design of compression and flexural Cold-formed Steel members		

UNIT I - ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS	(9+3)
Roof trusses - Roof and side coverings - Design of truss elements - Design of purlins - Design of end bearings - Gable column, gable rafter, gable wind girder and end bracings of industrial buildings - Introduction to the design of steel structures for fire loads - Aseismic design of steel buildings.	
UNIT II - DESIGN OF CONNECTIONS	(9+3)
Types of connections - Structural joints - Welded and Bolted – Throat and Root Stresses in Fillet Welds - Seated Connections - Unstiffened and Stiffened seated Connections - Moment Resistant Connections - Clip angle Connections - Split beam Connections - Framed Connections.	
UNIT III - PLASTIC ANALYSIS OF STRUCTURES	(9+3)
Introduction - Shape factors - Mechanisms - Plastic hinge - Analysis of beams and portal frames - Design of fixed and continuous beams and portal frame	
UNIT IV - SPECIAL STRUCTURES	(9+3)
Water tanks - Water pressure on tank walls - Seismic Analysis of water tank - Types of chimneys - Components of chimney - Design of self-supporting chimney - Design of Silos - Bunker design - Design of towers.	
UNIT V - DESIGN OF LIGHT GAUGE STEEL STRUCTURES	(9+3)
Types of cold formed cross sections - Local buckling - Design of compression and tension members - Design of beams - General concept of pre-engineered buildings - Simple portal frame design.	
TOTAL (L:45, T:15) : 60 PERIODS	

REFERENCES:

1. Subramanian N, "Design of Steel Structures", 2nd Edition, Oxford University Press, New Delhi, 2015.
2. Duggal. S K, "Limit State Design of Steel Structures", 3rd Edition, McGraw Hill Private Limited, New Delhi, 2017.
3. Wie Wen Yu, Design of Cold-Formed Steel Structures, McGraw Hill Book Company, 2019
4. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons, 1997

Mapping of COs with POs / PSOs								
COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	3	2	3	3	3	3	2	3
2	2		3	3	2	3	3	3
3			2	3		2		3
4	3	2	3	3	3	3	3	3
5	2			2	3	3		2
CO (W.A)	2.5	2	2.75	2.8	2.75	2.8	2.67	2.8

22STB06 - FINITE ELEMENT ANALYSIS IN STRUCTURAL ENGINEERING					
		L	T	P	C
		3	1	0	4
PRE REQUISITE : NIL					
Course Objectives			Course Outcomes		
1.0	To impart fundamental knowledge on the finite element method and its applications	1.1	The student will be able to demonstrate the concept of finite element analysis and approximate solutions, techniques		
2.0	To gain knowledge on one dimensional structural engineering problems	2.1	The student will be able to execute finite element analysis concept in one dimensional element problems		
3.0	To Acquire knowledge about the finite element analysis of 2-D and 3-D problems	3.1	The student will be able to apply the finite element analysis concept in two and three dimensional element problems		
4.0	To understand the FEM analysis for framed structures Analyse the framed structures using FEM analysis	4.1	The student will be able to analyze the framed structures		
5.0	To study the applications of FEM	5.1	The student will be able to apply finite element analysis concept in nonlinear, vibration and thermal problems		
UNIT I - INTRODUCTION					(9+3)
Approximate solutions of boundary value problems-Methods of weighted residuals, approximate solution using variational method, Modified Galerkin method. Basic finite element concepts - Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method.					
UNIT II - ONE DIMENSIONAL PROBLEMS					(9+3)
One dimensional problems - Coordinate systems - global, local and natural coordinate systems, shape functions - Bar, beam and truss element - Generation of Stiffness Matrix and Load Vector.					
UNIT III - TWO AND THREE DIMENSIONAL PROBLEMS					(9+3)
Two Dimensional problems - Plane Stress, Plane Strain Problems -Triangular and Quadrilateral Elements - Isoparametric Formulation - Natural Coordinates, Shape function, stiffness matrix - Asymmetric Problems - Higher Order Elements -Numerical Integration - Three dimensional elasticity - Governing differential equations - Higher order Isoparametric solid elements					
UNIT IV - ANALYSIS OF FRAMED STRUCTURES					(9+3)
Stiffness of Truss Member - Analysis of Truss - Stiffness of Beam Member - Finite Element Analysis of Continuous Beam - Plane Frame Analysis - Numerical Evaluation of Element Stiffness - Formulation for 3 Dimensional Elements - Solution for simple frames					
UNIT V - APPLICATIONS					(9+3)
Finite Elements for Elastic Stability - Dynamic Analysis - Nonlinear, Vibration and Thermal Problems - Meshing and Solution Problems - Modeling and analysis using FEA software's.					
TOTAL (L:45 ,T:15) : 60 PERIODS					

REFERENCES:

1. S. S. Bhavikatti, "Finite Element Analysis", 4th Edition, New Age Publishers, 2005
2. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2006
3. Seshu, P, "Text Book of Finite Element Analysis", Prentice - Hall of India Pvt. Ltd., New Delhi, 2004
4. Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", 4th Edition, Prentice Hall of India, 2015.
5. C. Krishnamoorthy, "Finite Element Analysis: Theory and Programming", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2017.

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2		2	2			2	2
2			2	3		2		2
3	2		2	3	2	1	2	2
4		2		3	3	3	2	2
5	2		2		2		3	2
CO (W.A)	2	2	2	2.75	2.33	2	2.25	2



22STX02 - EXPERIMENTAL TECHNIQUES AND ANALYSIS					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives			Course Outcomes		
1.0	To study about the measurements and performance of strains.	1.1	The students will be able to evaluate the measurement system of strains in structural elements		
2.0	To learn about the characteristics of structural vibrations measurements.	2.1	The students will be able to assess the different measurement method of vibrations		
3.0	To gain knowledge about the non-destructive structures testing and wind flow measurements	3.1	The students will be able to demonstrate on various testing methods and technologies.		
4.0	To understand the concepts of distress measurements and control	4.1	The students will be able to analyse the construction and damage assessment of RC Structures		
5.0	To apply the non destructive testing on various structures and elements.	5.1	The students will be able to determine strength by using NDT testing		

UNIT I - STRAIN MEASUREMENTS	(9)
Methods of measurements-Errors in measurements - Calibration of Testing Machines - Strain gauge, Principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges - Electronic load cells - Proving Rings.	
UNIT II - VIBRATION MEASUREMENTS	(9)
Characteristics of Structural Vibrations - Linear Variable Differential Transformer (LVDT) - Transducers for velocity and acceleration measurements. Vibration meter - Seismographs - Vibration Analyzer - Display and recording of signals - Cathode Ray Oscilloscope - XY Plotter - Chart Plotters - Digital data Acquisition systems.	
UNIT III - ACOUSTICS AND WIND FLOW MEASURES	(9)
Principles of pressure and flow measurements - pressure transducers - sound level meter - venturimeter - flow meters - wind tunnels and its uses in structural analysis - structural modeling - direct and indirect analysis.	
UNIT IV - DISTRESS MEASUREMENTS AND CONTROL	(9)
Diagnosis of distress in structures - crack observation and measurements - corrosion of reinforcement in concrete - Half cell, construction and use - damage assessment - controlled blasting for demolition - Techniques for residual stress measurements	
UNIT V NON DESTRUCTIVE TESTING METHODS	(9)
Load testing on structures, buildings, bridges and towers - Rebound Hammer - acoustic emission - ultrasonic testing principles and application - Holography - use of laser for structural testing - Brittle coating, Advanced NDT methods - Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR & GPR.	

REFERENCES:

1. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, 4th Edition, New Delhi, 2006.
2. Jindal U C ., "Experimental stress analysis", Pearson, New Delhi, 2013
3. Srinath.L.S, Raghavan.M.R, ingaiah.K, Gargasha.G, Pant.B and Ramachandra.K, "Experimental Stress Analysis", Tata McGraw Hill Company, New Delhi, 1984.
5. C. S. Rangan, "Instrumentation - Devices and Systems", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1983

Mapping of COs with POs / PSOs

COs	POs						PSOs	
	1	2	3	4	5	6	1	2
1	2		2	2		2	2	3
2	2	1	3	2		2		2
3	2		2		2	2	3	2
4	3			3		2	2	
5			2			2		3
CO (W.A)	1.8	1	2.25	2.33	2	2	2.33	2.5

