HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.E. CIVIL ENGINEERING

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

Curriculum & Syllabus

2019-2020

CHOICE BASED CREDIT SYSTEM

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE INSTITUTE

IV: To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values

MISSION OF THE INSTITUTE

IM1: To provide academic excellence in technical education through novel teaching methods

IM2: To empower students with creative skills and leadership qualities

IM3: To produce dedicated professionals with social responsibility

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE DEPARTMENT

DV: To be recognized globally for pre-eminence in Civil Engineering education, research and service

MISSION OF THE DEPARTMENT

DM1: To impart scientific and technical knowledge for professional practice, advanced study and research in Civil Engineering

DM2: To equip the students with ingenious leadership and organizational skills for a successful professional career

DM3: To inculcate professional and ethical responsibilities related to industry, society and environment

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The graduates will be able to:

PEO1: Excel as practicing engineers, academicians and researchers with a comprehensive knowledge in Civil Engineering

PEO2: Play a significant role as team players and leaders in challenging environments for nation's infrastructure development, environmental protection and sustainability

PEO3: Uphold professional and ethical responsibilities as engineers, consultants and entrepreneurs while addressing the demands of the society

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The graduates will be able to:

PSO1: Apply their engineering knowledge, communication skills, professional and ethical principles to solve problems in civil engineering and contribute to the infrastructure development in a sustainable way

PSO2: Use their engineering background to excel in competitive exams for advanced study, research and professional career

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DEPARTMENT OF CIVIL ENGINEERING

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

3. Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

CURRICULUM

B.E. CIVIL ENGINEERING
I TO VIII SEMESTERS CURRICULUM AND SYLLABI
SEMESTER I

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HSC	2	1	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BSC	3	1	0	4	25	75	100
THEORY WITH PRACTICAL COMPONENT										
3	19PH1151	Applied Physics	BSC	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BSC	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ESC	2	0	2	3	50	50	100
6	19ME1152	Engineering Drawing	ESC	1	0	4	3	50	50	100
PRACTICAL										
7	19HE1071	Language Competency Enhancement Course - I	HSC	1	0	0	1	100	-	100
MANDATORY COURSE										
8	19MC1191	Induction Programme	EEC	-	-	-	-	-	-	-
			Total	**13**	**2**	**10**	**20**	**350**	**350**	**700**

SEMESTER II

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HSC	2	1	0	3	25	75	100
2	19MA2101	Differential Equations and Complex Variables	BSC	3	1	0	4	25	75	100
3	19EE2103	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	25	75	100
4	19ME2101	Engineering Mechanics	ESC	3	0	0	3	25	75	100
THEORY WITH PRACTICAL COMPONENT										
5	19PH2151	Material Science	BSC	2	0	2	3	50	50	100
6	19CY2151	Environmental Studies	BSC	2	0	2	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices	ESC	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course -II	HSC	1	0	0	1	100	-	100
			Total	**16**	**2**	**8**	**22**	**350**	**450**	**800**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA3104	Fourier Analysis and Numerical Methods	3	0	0	3	25	75	100
2	16CE3201	Mechanics of Solids	3	2	0	4	25	75	100
3	16CE3202	Mechanics of Fluids	3	0	0	3	25	75	100
4	16CE3203	Construction Materials, Equipment &Practices	3	0	0	3	25	75	100
5	16CE3204	Surveying I	3	0	0	3	25	75	100
6	16CE3205	Environmental Science and Engineering	3	0	0	3	25	75	100
PRACTICAL									
7	16CE3001	Survey Lab	0	0	4	2	50	50	100
8	16CE3002	Computer Aided Building Drawing	0	0	4	2	50	50	100
		Total :	**18**	**2**	**8**	**23**			**800**

SEMESTER IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16MA4110	Applied Probability and Statistics	3	1	0	3	25	75	100
2	16CE4201	Strength of Materials	3	1	0	4	25	75	100
3	16CE4202	Applied Hydraulics and Hydraulic Machinery	3	0	0	3	25	75	100
4	16CE4203	Soil Mechanics	3	0	0	3	25	75	100
5	16CE4204	Surveying II	3	0	0	3	25	75	100
6	16CE4205	Highway & Railway Engineering	3	0	0	3	25	75	100
7	16CE4001	Strength of Materials Lab	0	0	4	2	50	50	100
8	16CE4002	Fluid Mechanics and Hydraulic Machinery Lab	0	0	4	2	50	50	100
		TOTAL CREDITS	**18**	**2**	**8**	**23**	**250**	**550**	**800**

For the students admitted during the academic year 2017-2018 and onwards

SEMESTER V

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE5201	Structural Analysis I	3	1	0	4	25	75	100
2	16CE5202	Design of RCC Elements	3	0	0	3	25	75	100
3	16CE5203	Design of Steel Structures	3	0	0	3	25	75	100
4	16CE5204	Water supply Engineering	3	0	0	3	25	75	100
5	16CE5205	Foundation Engineering	3	0	0	3	25	75	100
6	16CE53XX	**Professional Elective – I**	3	0	0	3	25	75	100
7	16CE5001	Soil Mechanics Laboratory	0	0	4	2	50	50	100
8	16CE5002	Concrete and Highway Laboratory	0	0	4	2	50	50	100
9	16CE5003	Survey Camp	0	0	0	1	0	100	100
		TOTAL CREDITS	**18**	**1**	**8**	**24**	**250**	**650**	**900**

***Survey camp of two weeks has to be undergone by the student during fourth semester vacation.**

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE6201	Structural Analysis II	3	1	0	4	25	75	100
2	16CE6202	Design of RCC Structures	3	0	0	3	25	75	100
3	16CE6203	Hydrology	3	0	0	3	25	75	100
4	16CE6204	Wastewater Engineering	3	0	0	3	25	75	100
5	**16CE63XX**	**Professional Elective II**	3	0	0	3	25	75	100
6	**16XX64XX**	**Open Elective I**	3	0	0	3	25	75	100
7	16CE6001	Environmental Engineering Lab	0	0	4	2	50	50	100
8	16CE6002	Design and Drawing- I (RCC & Steel)	0	0	4	2	50	50	100
		TOTAL CREDITS	**18**	**1**	**8**	**23**	**250**	**550**	**800**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE5301	Advanced Surveying Techniques	3	0	0	3	25	75	100
2	16CE5302	Remote Sensing and GIS	3	0	0	3	25	75	100
3	16CE5303	Bridge Engineering	3	0	0	3	25	75	100
4	16CE5304	Construction Planning and Scheduling	3	0	0	3	25	75	100
5	16CE5305	Airports, Docks and Harbour Engineering	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE6301	Architecture	3	0	0	3	25	75	100
2	16CE6302	Interior Design	3	0	0	3	25	75	100
3	16CE6303	Urban Planning and Development	3	0	0	3	25	75	100

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4	16CE6304	Housing Planning and Management	3	0	0	3	25	75	100
5	16CE6305	Engineering Economics and Cost Analysis	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE6401	Building Services	3	0	0	3	25	75	100

For the students admitted during the academic year 2016-2017 and onwards

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE7201	Estimation, Costing and Valuation Engineering	3	0	0	3	25	75	100
2	16CE7202	Concrete Technology	3	0	0	3	25	75	100
3	16CE7203	Irrigation and Hydraulic Structures	3	0	0	3	25	75	100
4	16CE73XX	Professional Elective III	3	0	0	3	25	75	100
5	16CE73XX	Professional Elective IV	3	0	0	3	25	75	100
6	16XX74XX	Open Elective II	3	0	0	3	25	75	100
7	16CE7001	Design and Drawing – II(Irrigation &Env. Engg.)	0	0	4	2	50	50	100
8	16CE7002	Design Project	0	0	6	3	50	50	100
9	**16CE7701**	**Implant Training / Internship***	0	0	0	2	0	100	100
		TOTAL	**18**	**0**	**10**	**25**	**250**	**650**	**900**

SEMESTER VIII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CE8201	Structural Dynamics and Earthquake Engineering	3	0	0	3	25	75	100
2	16CE83XX	Professional Elective V	3	0	0	3	25	75	100

3	16CE83XX	Professional Elective VI	3	0	0	3	25	75	100
PRACTICAL									
4	16CE8901	Project Work	0	0	16	8	100	100	200
		Total :	**9**	**0**	**16**	**17**	**175**	**325**	**500**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – III

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE7301	Air Pollution Management	3	0	0	3	25	75	100
2	16CE7302	Environmental Impact Assessment	3	0	0	3	25	75	100
3	16CE7303	Municipal Solid Waste Management	3	0	0	3	25	75	100
4	16CE7304	Hazardous Waste Management and Site Remediation	3	0	0	3	25	75	100
5	16CE7305	Industrial Wastewater Engineering	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE7306	Design of Masonry and Timber Structures	3	0	0	3	25	75	100
2	16CE7307	Disaster Resistant Structures	3	0	0	3	25	75	100
3	16CE7308	Tall Buildings	3	0	0	3	25	75	100
4	16CE7309	Finite Element Techniques	3	0	0	3	25	75	100
5	16CE7310	Prefabricated Structures	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – V

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE8301	Computer Aided Design of Structures	3	0	0	3	25	75	100

2	16CE8302	Design of Industrial Structures	3	0	0	3	25	75	100
3	16CE8303	Design of Prestressed Concrete Structures	3	0	0	3	25	75	100
4	16CE8304	Repair and Rehabilitation of Structures	3	0	0	3	25	75	100
5	16CE8305	Valuation of Land and Buildings	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – VI

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE8306	Groundwater Engineering	3	0	0	3	25	75	100
2	16CE8307	Integrated Water Resources Management	3	0	0	3	25	75	100
3	16CE8308	Rock Engineering	3	0	0	3	25	75	100
4	16CE8309	Ground Improvement Techniques	3	0	0	3	25	75	100
5	16CE8310	Earth Retaining Structures	3	0	0	3	25	75	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE7402	Strategies of Green Buildings	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

REGULATION -2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	23	23	24	23	25	17	**187**

REGULATION -2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	22	22	20	18	**165**

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Dean (Academics)
HiCET

Principal

PRINCIPAL
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COIMBATORE - 641 032

SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1101	**TECHNICAL ENGLISH (Common to All Branches)**	2	1	0	3

Course Objective

1. 1. Train to maintain coherence in formal communication.
2. Provide Practice to create and interpret descriptive communication.
3. Introduce the professional protocol.
4. Acquiredifferent types of communication and professional etiquette.
5. Educate to improve interpersonal and intrapersonal skills.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) **Reading** –Reading articles from newspaper, Reading comprehension **Writing** Chart analysis, process description, Writing instructions **Grammar andVocabulary-** Tenses, Regular and irregular verb, technical vocabulary.	9
II	**Listening and Speaking-** listening to product description, equipment & work place (purpose, appearance, function) **Reading-** Reading technical articles **Writing-** Letter phrases, writing personal letters, **Grammar and Vocabulary**-articles, Cause & effect, Prepositions.	9
III	**Listening and Speaking-** listening to product description, equipment & work place (purpose, appearance, function) **Reading-** Reading technical articles **Writing-** Letter phrases, writing personal letters, **Grammar and Vocabulary**-articles, Cause & effect, Prepositions.	9
IV	**Listening and Speaking-** - Practice telephone skills and telephone etiquette (listening and responding, asking questions).**Reading-** Reading short texts and memos **Writing-** invitation letters, accepting an invitation and declining an invitation **Grammar and Vocabulary**- Modal verbs, Collocation, Conditionals,Subject verb agreement and Pronoun-Antecedent agreement.	9
V	**Listening and Speaking-** listening to technical group discussions and participating in GDs**Reading-** reading biographical writing - **Writing-** Proposal writing, Writing definitions, **Grammar and Vocabulary**- Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1- To gain knowledge about basic grammar and elements of professional communication.

CO2- To understand formal and technical communication.

CO3- To apply the basic elements of grammar and communication in professional situation.

CO4- To analyse and interpret different styles of correspondence.

CO5- To compose official letters and technical proposals and make presentations.

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TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2-Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.

R2- Raymond Murphy, "English Grammar in Use"-4th editionCambridge University Press, 2004.

R3- KamaleshSadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech.	19MA1102	CALCULUS AND LINEAR ALGEBRA (COMMON TO AERO, AGRI, AUTO, CIVIL, FOOD, MECH, MECHT)	3	1	0	4

Course Objective

1. Understand the concept of differentiation
2. Evaluate the functions of several variables which are needed in many branches of engineering
3. Understand the concept of double integrals
4. Understand the concept of triple integrals
5. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications

Unit	Description	Instructional Hours
	DIFFERENTIAL CALCULUS	
I	Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
	MULTIVARIABLE CALCULUS (DIFFERENTIATION)	
II	Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
	DOUBLE INTEGRATION	
III	Double integrals in Cartesian coordinates – Area enclosed by the plane curves (excluding surface area) – Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped.	12
	TRIPLE INTEGRATION	
IV	Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.	12
	MATRICES	
V	Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Apply the concept of differentiation in any curve
CO2: Identify the maximum and minimum values of surfaces
CO3: Apply double integrals to compute area of plane curves
CO4: Evaluation of triple integrals to compute volume of solids
CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

T2 - Veerarajan T., "Engineering Mathematics", McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2016.

REFERENCE BOOKS:

R1 - Thomas & Finney "Calculus and Analytic Geometry", Sixth Edition, Narosa Publishing House, New Delhi.

R2 - Weir,M.D and Joel Hass, ' Thomas Calculus" 12th Edition,Pearson India 2016.

R3 - Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19PH1151	APPLIED PHYSICS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles
3. Extend the knowledge about wave optics
4. Gain knowledge about laser and their applications
5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment. Determination of Young's modulus by uniform bending method	6+3(P)
II	**OSCILLATONS** Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment. Determination of Rigidity modulus – Torsion pendulum	6+3(P)
III	**WAVE OPTICS** Conditions for sustained Interference – air wedge and it's applications - Diffraction of light – Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. Determination of wavelength of mercury spectrum – spectrometer grating Determination of thickness of a thin wire – Air wedge method	6+6(P)
IV	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO_2 laser- Laser Applications – Holography – Construction and reconstruction of images. Determination of Wavelength and particle size using Laser	6+3(P)
V	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
	Total Instructional Hours	45

Course Outcome

After completion of the course the learner will be able to
CO1: Illustrate the fundamental properties of matter
CO2: Discuss the Oscillatory motions of particles
CO3: Analyze the wavelength of different colors
CO4: Understand the advanced technology of LASER in the field of Engineering
CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:

T1 - Rajendran V., "Applied Physics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2 - Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics", Tata McGraw Hill, New Delhi, 2015.
R2 – M.N Avadhanulu and Kshirsagar P.G., "A Text Book of Engineering Physics", S. Chand and Company Ltd., New Delhi, 2016
R3 – Senthilkumar G., "Engineering Physics – I", VRB publishers Pvt. Ltd., 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques
2. The principles of polymer chemistry and engineering applications of polymers and composites
3. The principles of electrochemistry and with the mechanism of corrosion and its control
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells
5. The important concepts of spectroscopy and its applications

Unit	Description	Instructional Hours
	WATER TECHNOLOGY	
I	Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. **Estimation of total, permanent and temporary hardness of water by EDTA.**	6+3(P)
	POLYMER & COMPOSITES	
II	Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
	ELECTROCHEMISTRY AND CORROSION	
III	Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using BaCl2 and Na2SO4.** **Estimation of Ferrous iron by Potentiometry.**	6+9(P)
	ENERGY SOURCES AND STORAGE DEVICES	
IV	Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	6
	ANALYTICAL TECHNIQUES	
V	Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. **Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).**	6+3(P)
	Total Instructional Hours	45

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Course Outcome	CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance. CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design. CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities. CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS:

T1 - P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, Chennai (2019).
T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objective

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs
3. To develop Python programs with conditionals and loops and to define Python functions and call them
4. To use Python data structures – lists, tuples, dictionaries
5. To do input/output with files in Python

Unit	Description	Instructional Hours
	ALGORITHMIC PROBLEM SOLVING	
I	Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: Find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
	DATA, EXPRESSIONS, STATEMENTS	
II	Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. **Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.**	7+2(P)
	CONTROL FLOW, FUNCTIONS	
III	Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. **Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.**	5+4(P)
	LISTS, TUPLES, DICTIONARIES	
IV	Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension. **Illustrative programs: selection sort, insertion sort, merge sort, histogram.**	3+6(P)
	FILES, MODULES, PACKAGES	
V	Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages. **Illustrative programs: word count, copying file contents.**	5+4(P)
	Total Instructional Hours	**45**

Course Outcome

CO1: Develop algorithmic solutions to simple computational problems
CO2: Read, write, execute by hand simple Python programs

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CO3: Structure simple Python programs for solving problems and Decompose a Python program into functions

CO4: Represent compound data using Python lists, tuples, dictionaries

CO5: Read and write data from/to files in Python Programs

TEXT BOOKS:

T1 – Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.6.2", Shroff Publishers, First Edition, 2017.

T2 - Annadurai S., Shankar S, Jasmine J., Revathi M., "Fundamentals of Python Programming", McGraw Hill Education (India) Private Ltd., 2019.

REFERENCE BOOKS:

R1 - Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.

R2 - Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.

R3 - Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME1152	ENGINEERING DRAWING	1	0	4	3

Course Objective

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves
2. To learn about the orthogonal projections of straight lines and planes
3. To acquire the knowledge of projections of simple solid objects in plan and elevation
4. To learn about the projection of sections of solids and development of surfaces
5. To study the isometric projections of different objects

Unit	Description	Instructional Hours
	PLANE CURVES	
I	Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
	PROJECTIONS OF POINTS, LINES AND PLANE SURFACES	
II	Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
	PROJECTIONS OF SOLIDS	
III	Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	
IV	Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to 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. Development of lateral surfaces of truncated solids.	12
	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	
V	Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
	Total Instructional Hours	**60**

Course Outcome

Upon Completion of the course students will be able to
CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves
CO2: Draw the orthogonal projections of straight lines and planes
CO3: Interpret the projections of simple solid objects in plan and elevation
CO4: Interpret the projections of simple solid objects in plan and elevation
CO5: Draw the isometric projections and the perspective views of different objects

TEXT BOOKS:

T1 – K.Venugopal , Prabu Raja V., "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New Delhi 2016.
T2 – K.V. Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai, 2009,

REFERENCE BOOKS:

R1 - Basant Agrawal and C. M .Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi 2008.
R2 – N.S.Parthasarathy., Vela Murali, "Engineering Drawing", Oxford University Press, India 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

1. To enhance student language competency
2. To identify individual students level of communication skills
3. To develop English Vocabulary and spoken communication skills.
4. To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
	Listening	
I	Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
	Reading	
II	English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
	Speaking	
III	Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
	Writing	
IV	Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
	Art of Communication	
V	Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	3
	Total Instructional Hours	**15**

Course Outcome

CO1: Trained to maintain coherence and communicate effectively.

CO2: Practiced to create and interpret descriptive communication.

CO3: Introduced to gain information of the professional world.

CO4: acquired various types of communication and etiquette.

CO5: Taught to improve interpersonal and intrapersonal skills

REFERENCE BOOKS:

R1 - Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill

R2 - Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.

R3 - High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

1. Introduce business communication.
2. Train to respond different professional situations.
3. Make the learners familiar with the managerial skills
4. Empower the trainee in business writing skills.
5. Educate to interpret and expertise different business content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	9
II	**Listening and Speaking-** listening to TED talks **Reading-**Making and interpretation of posters**Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success"**Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech..	9
IV	**Listening and Speaking-** Role play- **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	9
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company **- Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling& number rules).	9
	Total Instructional Hours	45

Course Outcome

CO1:To know different modes of business communication
CO2: To understand managerial techniques.
CO3: To apply the rules of grammar and vocabulary in effective business communication.
CO4: To analyze and interpret business documents.
CO5:To draft business reports

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.
T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES (COMMON TO AERO, AGRI, AUTO, CIVIL, FOOD, MECH, MECH)	3	1	0	4

Course Objective

1. Describe some methods to solve different types of first order differential equations.
2. Use the effective mathematical tools for the solutions of partial differential equations.
3. Describe the construction of analytic functions and conformal mapping.
4. Illustrate Cauchy's integral theorem and calculus of residues
5. Solve ordinary differential equations of certain types using Wronskian technique

Unit	Description	Instructional Hours
	FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	
I	Solutions of Equations of the first order and of the first degree – Variable seperable method- Homogeneous equations – Exact differential equations (Excluding non Exact differential Equations) – Linear equations – Equations reducible to the linear form – Bernoulli's equation	12
	PARTIAL DIFFERENTIAL EQUATIONS	
II	Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form f(p,q)=0, Clairaut's type : z = px+qy +f(p,q) – Lagrange's linear equation.	12
	COMPLEX DIFFERENTIATION	
III	Functions of complex variables – Analytic functions – Cauchy's – Riemann's equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.	12
	COMPLEX INTEGRATION	
IV	Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem.	12
	ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER	
V	Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers.	12
	Total Instructional Hours	**45 + 15 = 60**

Course Outcome

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Solve Partial Differential Equations using various methods.
CO3: Infer the knowledge of construction of analytic functions and conformal mapping.
CO4: Evaluate real and complex integrals over suitable closed paths or contours.
CO5: Develop sound knowledge of techniques in solving ordinary differential equations

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2- Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

REFERENCE BOOKS :

R1- Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE2103	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

Course Objective

1. To understand the basic laws and apply them in Electrical circuits and understand different measuring instruments
2. To impart knowledge on construction and working of DC and AC machines
3. To create awareness on the methods for electrical safety, load protection basics
4. To provide knowledge on the fundamentals of semiconductor devices and their applications
5. To impart knowledge on digital electronics and its principles

Unit	Description	Instructional Hours
	ELECTRICAL CIRCUITS AND MEASUREMENTS	
I	Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase circuits - Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters, Dynamometer type Watt meters and Energy meters.	9
	ELECTRICAL MACHINES	
II	Construction, Principle of Operation of DC Generators - EMF Equation - Construction, Principle of Operation of DC shunt and series Motors, Single Phase Transformer - EMF Equation, Single phase capacitor start - capacitor run – Construction, Principle of Operation of Three Phase Induction Motor – Applications (Qualitative Approach only).	9
	ELECTRICAL WIRING AND SAFETY	
III	Wiring types and applications: Service mains, meter board and distribution board - Brief discussion on concealed conduit wiring. One way and two way control. Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock, Objectives for Neutral and Earthing, types of earthing; pipe and plate earthing, Residual current circuit breaker.	9
	SEMICONDUCTOR DEVICES AND APPLICATIONS	
IV	Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics – FET – Characteristics.	9
	DIGITAL ELECTRONICS	
V	Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops (RS, JK, T & D), A/D and D/A Conversion (Dual Slope, SAR, Binary-weighted and R-2R).	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Apply the KVL and KCL in Electrical circuits.
CO2: Explain the constructional features of AC and DC machines
CO3: Develop awareness on the methods for electrical safety, load protection basics
CO4: Identify electronics components and use them to design circuits
CO5: Develop combinational and sequential logic circuits

TEXT BOOKS:

T1 - Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Eighteenth Reprint, 2014.
T2 - Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.

REFERENCE BOOKS:

R1 - Premkumar N, "Basic Electrical and Electronics Engineering", Anuradha Publishers, 2018.
R2 - Mehta V K, "Principles of Electronics", S. Chand & Company Ltd, 1994.
R3 - Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME2101	ENGINEERING MECHANICS	3	0	0	3

Course Objective

1. To understand basic concepts and force systems in a real world environment.
2. To understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. To understand the moment of surfaces and solids.
4. To understand the effect of static friction on equilibrium.
5. To understand the dynamic equilibrium equation.

Unit	Description	Instructional Hours
	STATICS OF PARTICLES	
I	Introduction to engineering mechanics - Classifications, force vector, Law of mechanics, System of forces, transmissibility, Force on a particle – resultant of two forces and several concurrent forces – resolution of a force – equilibrium of a particle — forces in space – equilibrium of a particle in space.	9
	EQUILIBRIUM OF RIGID BODIES	
II	Free body diagram, moment of a force – varignon's theorem – moment of a couple – resolution of a force and a couple. Support reactions of the beam.	9
	CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA	
III	Centroids of simple plane areas, composite areas, determination of moment of inertia of composite plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.	9
	FRICTION	
IV	Laws of dry friction – angles of friction- angle of repose-coefficient of static and kinetic friction – – Friction in inclined plane, Ladder friction, Screw friction– rolling resistance – belt friction.	9
	DYNAMICS OF PARTICLES	
V	Rectilinear and Curvilinear motion, -Newton's II law – D'Alembert's principle- Energy - potential energy kinetic energy-conservation of energy-work done by a force - work energy method, Impulse momentum method, Impact of bodies, Translation and rotation of the particles.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, students will be able to
CO1: Define and illustrate the basic concepts of force system
CO2: Identify the resultant force and couple, support reactions of the beam
CO3: Calculate the Centre of gravity and moment of inertia of an object
CO4: Examine the friction force of particles and objects for Impending Motion
CO5: Determine the displacement, velocity and acceleration of particles and objects

TEXT BOOKS:

T1. F.P.Beer, and Jr. E.R.Johnston., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 11th Edition, Tata McGraw-Hill Publishing company, New Delhi (2018).
T2. NH.Dubey, "Engineering Mechanics", Tata Mcraw Hill, New Delhi, 2016.

REFERENCE BOOKS:

1. R.C.Hibbeller, and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. S.S.Bhavikatti, and K.G.Rajashekarappa, "Engineering Mechanics", New Age International (P) Limited Publishers, 2015.
3. P. Jaget Babu, "Engineering Mechanics", Pearson Education, India Ltd, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19PH2151	MATERIAL SCIENCE (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program
2. Extend the knowledge about the magnetic materials
3. Explore the behavior of super conducting materials
4. Gain knowledge about Crystal systems
5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
	SEMICONDUCTING MATERIALS	
I	Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative). **Determination of band gap of a semiconductor** **Determination of acceptance angle and numerical aperture in an optical fibre**	6+6(P)
	MAGNETIC MATERIALS	
II	Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. **B – H curve by Magnetic hysteresis experiment**	6+3(P)
	SUPERCONDUCTING MATERIALS	
III	Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
	CRYSTAL PHYSICS	
IV	Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
	ULTRASONICS	
V	Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system. **Determination of velocity of sound and compressibility of liquid – Ultrasonic wave** **Determination of co-efficient of viscosity of a liquid – Piseuille's method**	6+6(P)
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor
CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday
CO3: Discuss the behavior of super conducting materials
CO4: Illustrate the types and importance of crystal systems
CO5: Evaluate the production of ultrasonics and its applications in NDT

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016
R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CY2151	ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The importance of environmental education, ecosystem and biodiversity.
2. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. The natural resources, exploitation and its conservation
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	
I	Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity	6
	NATURAL RESOURCES	
II	Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources	6
	ENVIRONMENTAL POLLUTION	
III	Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. **Determination of Dissolved Oxygen in sewage water by Winkler's method.** **Estimation of alkalinity of water sample by indicator method.** **Determination of chloride content of water sample by argentometric method.**	6+9(P)
	SOCIAL ISSUES AND THE ENVIRONMENT	
IV	From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. **Determination of pH in beverages.**	6+3(P)
V	**HUMAN POPULATION AND THE ENVIRONMENT**	6+3(P)

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Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health.

Estimation of heavy metal ion (Copper) in effluents by EDTA.

Total Instructional Hours **45**

Course Outcome

CO1: Realize the importance of ecosystem and biodiversity for maintaining ecological balance.

CO2: Understand the causes of environmental pollution and hazards due to manmade activities.

CO3: Develop an understanding of different natural resources including renewable resources.

CO4: Demonstrate an appreciation for need for sustainable development and understand the various Social issues and solutions to solve the issues.

CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

T1-S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020

T2-Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

R1-Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015

R2-G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

R3-Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME2001	ENGINEERING PRACTICES LABORATORY	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering

Expt . No.	Description of the Experiment
	GROUP A (CIVIL AND MECHANICAL ENGINEERING PRACTICES)
1.	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows
2.	Arrangement of bricks using English Bond for 1 brick thick wall for right angle corner junction and T- junction
3.	Arrangement of bricks using English Bond for 11/2 brick thick wall for right angle corner and T- junction
4.	Preparation of arc welding of Butt joints, Lap joints and Tee joints
5.	Practice on sheet metal Models– Trays and funnels
6.	Hands-on-exercise in wood work, joints by sawing, planning and cutting
7.	Practice on simple step turning, taper turning and drilling
8.	Practice on Drilling
9.	Demonstration on Foundry operation
10.	Demonstration on Power tools
	GROUP B (ELECTRICAL ENGINEERING PRACTICES)
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter
2.	Fluorescent lamp wiring
3.	Stair case wiring
4.	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits
5.	Measurement of energy using single phase energy meter
6.	Soldering practice using general purpose PCB
7.	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator
8.	Study of Energy Efficient Equipments and Measuring Instruments

Total Practical Hours: 45

Course Outcome

At the end of the course the students shall be able to

- Fabricate wooden components and pipe connections including plumbing works
- Fabricate simple weld joints
- Fabricate different electrical wiring circuits and understand the AC Circuits

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

1. To improve communication skills and Professional Grooming.
2. To impart deeper knowledge of English Language and its practical application in different facets of life.
3. To equip the techniques of GD, Public Speaking, debate etc.

Unit	Description	Instructional Hours
	Listening	
I	Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
	Reading	
II	Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
	Speaking	
III	Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
	Writing	
IV	Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
	Language Development	
V	Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
	Total Instructional Hours	**15**

Course Outcome

CO1: Introduced to different modes and types of communication.
CO2: Practiced to face and react to various professional situations efficiently.
CO3: learnt to practice managerial skills.
CO4: Familiarized with proper guidance to writing.
CO5: Trained to analyze and respond to different types of communication.

REFERENCE BOOKS:

R1 - Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill
R2 - Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
R3 - High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.
R4 - Practical course in Spoken English by J.K. Gangal,PHI Learning , Second edition, 1 January 2018.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA3104	FOURIER ANALYSIS AND NUMERICAL METHODS (Common to CIVIL & MECHATRONICS)	3	0	0	3

Course Objective

1. Introduce Fourier series analysis which is central to many applications in engineering.
2. Solve boundary value problems by applying Fourier series.
3. Acquaint with Fourier transform techniques used in wide variety of situations.
4. Familiar with the concepts of numerical differentiation and numerical integration.
5. Find the numerical solution of ordinary differential equations as most of the engineering problems are expressed in the form of differential equations.

Unit	Description	Instructional Hours
I	**FOURIER SERIES** Introduction - Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	9
II	**BOUNDARY VALUE PROBLEMS** Classification – solution of one dimensional wave equation – one dimensional heat equation –Fourier series solution in Cartesian coordinates.	9
III	**FOURIER TRANSFORMS** Fourier Transform Pair-Fourier sine and cosine transforms – Properties-Transforms of Simple functions – Convolution Theorem – Parseval's identity.	9
IV	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Differentiation using interpolation formula – Newton's forward and backward interpolation for equal intervals – Numerical integration by Trapezoidal and Simpson's 1/3 rule – Double integration using Trapezoidal and Simpson's rules.	9
V	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods: Taylor's series method – Modified Euler's method for first order equation – Fourth order Runge- kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method.	9
Total Instructional Hours		**45**

Course Outcome

CO1: Understand the mathematical principles of Fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering.
CO2: Acquire the knowledge of application of Fourier series in solving the heat and wave equations.
CO3: Understand the mathematical principles on Fourier transforms and able to solve some of the physical problems of engineering..
CO4: Evaluate many numerical integration problems and appreciate their applications for engineering problem solving.
CO5: Obtain the knowledge of solving ordinary differential equations using single and multi step methods.

TEXT BOOKS:

T1 - Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd.,
Second reprint, New Delhi, 2012.
T2 - Grewal.B.S. " Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, 2007.

REFERENCE BOOKS :

R1 - Kreyszig.E."Advanced Engineering Mathematics", Eight Edition, John Wiley & sons (Asia ltd 2007.
R2 - Kandasamy P., Thilagavathy K. and Gunavathy K.,"Engineering Mathematics Volume III", S. Chand &Company Ltd., New Delhi, 2010.
R3 - Kandasamy P., Thilagavathy K. and Gunavathy K.,"Numerical methods", S. Chand & Company Ltd., New Delhi, 2010.
R4- S.K.Gupta, Numerical Methods for Engineers", New Age International Pvt.Ltd Publishers,2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3201	MECHANICS OF SOLIDS	3	1	0	4

Course Objective

1. To study the state of stresses and strains in structural components subjected to different loading conditions.
2. To gain knowledge on shear force and bending moment for all statically determinate and indeterminate beams by recognizing the beam type and loading.
3. To learn the concepts of internal stress in beams of various cross sections.
4. To analyze the members under complex state of stress by means of analytical and graphical methods.
5. To understand the behaviour of members subjected to pure torsion and shear.

Unit	Description	Instructional Hours
	TENSION, COMPRESSION AND SHEAR	
I	Introduction - Stress and strain - Mechanical properties of materials - Elasticity, plasticity and creep - Linear elasticity- Hooke's law - Poisson's ratio - Elastic constants- Allowable stresses and allowable loads - Thermal stresses in compound bars -Impact loading.	9+3
	SHEAR FORCE AND BENDING MOMENT	
II	Introduction - Types of beams, loads and reactions - Shear force and bending moment - Relationships between load, shear force and bending moment – Shear force and bending moment diagrams.	9+3
	STRESSES IN BEAMS	
III	Introduction - Pure bending and non-uniform bending - Curvature of a beam - Longitudinal strains in beams - Normal stresses in beams – Non- prismatic beams - Shear stresses in beams of rectangular, circular, T and I section - Built-up beams and shear flow.	9+3
	PRINCIPAL STRESS AND STRAIN	
IV	Plane stress - Principal stresses and maximum shear stress – Mohr's circle for plane stress - Determination of principal stresses and principal planes - plane strain - Applications of plane stress - Maximum stresses in beams-Spherical and deviatory components of stress tensor.	9+3
	TORSION OF SHAFTS AND SPRING	
V	Torsional deformations of a circular bar - Circular bars of linearly elastic materials – Non uniform torsion - Stresses and strains in pure shear - transmission of power by circular shafts - Stepped shafts - Shafts fixed at both ends - Strain energy in torsion and pure shear - Springs – Types- Helical and leaf springs – Stresses and deflection of springs.	9+3
	Total Instructional Hours	**45+15=60**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Realize the state of stresses and strains in structural components under tension, compression and shear.

CO2: Plot the Shear force and bending moment diagrams for all the statically determinate and indeterminate beams.

CO3: Analyse the beam for internal stress.

CO4:Evaluate the elements subjected to complex state of stress by means of analytical and graphical methods

CO5: Comprehend the behaviour of members under pure torsion and shear.

TEXT BOOKS:

T1-Bansal R.K. "Strength of materials", Laxmi Publications, New Delhi, 2012.

T2-Rajput.R.K."Strength of Materials", S.Chand and Co, New Delhi, 2015.

REFERENCE BOOKS:

R1-William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw-Hill publishing co., New Delhi, 2007.

R2-Ramamrutham, S., "Strength of Materials", DhanpatRai& Sons, 2014.

R3-Gambhir.M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3202	MECHANICS OF FLUIDS	3	0	0	3

Course Objective

1. To understand the properties of fluids.
2. To learn the basic concepts of fluid statics and pressure measurements.
3. To acquire knowledge on the concepts of fluid kinematics and dynamics.
4. To understand the behavior of flow through pipes.
5. To gather knowledge on dimensional analysis.

Unit	Description	Instructional Hours
	FLUID PROPERTIES	
I	Fluid – definition, distinction between solid and fluid - Properties of fluids - Density, Specific Weight, Specific Volume, Specific Gravity, Temperature, Viscosity, Compressibility, Vapour Pressure, Capillarity and Surface Tension.	9
	FLUID STATICS	
II	Pascal's and Hydrostatic Law – Pressure measuring devices (simple manometers, differential manometers: U tube, inclined and Mechanical gauges); Centre of pressure, total pressure on plane -Forces on plane – Buoyancy - Metacentric height.	9
	FLUID KINEMATICS & FLUID DYNAMICS	
III	Types of fluid flow – Velocity and Acceleration –Continuity equation in Cartesian co-ordinates -Velocity potential function and Stream function- Flow net -Euler's and Bernoulli's equations – Application of Bernoulli's equation – Orificemeter, Venturimeter. Measurement of Discharge – Momentum principle.	9
	FLOW THROUGH PIPES	
IV	Flow through pipes – Laminar flow through pipes and between plates – Hagen – Poiseullie equation – Turbulent flow- Major and minor losses of flow in pipes - Darcy Weisbach's equation - Moody's diagram –Flow through pipes in series and in parallel – Pipe networks - Hydraulic and energy gradient - Mouthpiece and orifice.	9
	DIMENSIONAL ANALYSIS	
V	Units and Dimensions – Dimensional homogeneity – Rayleigh's method – Buckingham Pi theorem –Similitude – Dimensionless Numbers and their significance Model Laws-Types of Models.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Use fluid properties to design pipes to carry particular amount of discharge.

CO2: Solve fluid statics problems and measure fluid pressure

CO3: Distinguish between various types of fluid flows and find the fluid velocity and discharge using principles of Kinematics and Dynamics.

CO4: Identify the laminar and turbulent flow through pipes and compute the energy losses in pipe flow.

CO5:Select appropriate model to provide solution to a real time problem related to hydraulics.

TEXT BOOKS:

T1 -Jain A.K., "Fluid Mechanics (including Hydraulic Machines)", Khanna Publishers, 2010.

T2 - Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2013.

REFERENCE BOOKS:

R1 -Pani B.S. "Fluid Mechanics: A concise introduction" PHI Learning EEE 2016

R2-Ramamrutham.S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons,Delhi,2014.

R3 -Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3203	CONSTRUCTION MATERIALS, EQUIPMENT AND PRACTICES	3	0	0	3

Course Objective

1. To familiarize the materials used in construction and their testing methods.
2. To study the properties of ingredients of concrete and its behavior in fresh and hardened state
3. To learn the codal provisions, construction and safety practices in construction industry.
4. To gain knowledge of super structure and sub structure construction methods and techniques.
5. To understand the application of various construction equipment.

Unit	Description	Instructional Hours
I	**CONSTRUCTION MATERIALS** Classification of rocks, Bricks – Manufacturing –Types – Uses - Properties – Building stones – Types – Uses - Tests on stones, Preservation of stones - Properties – Cement – Manufacturing, Types, Uses and Properties – Tests on Cement – Timber –Seasoning, Defects and application of timber – Plywood, Steel – Structural steel – Glass – Types and Uses – Paints – Constituents, Types and Uses.	9
II	**CONCRETE TECHNOLOGY** Concrete – Ingredients of concrete –Admixtures – Types & Uses – Batching – Mixing – Placing – Compacting – Curing – Properties of concrete – Segregation & Bleeding – Tests on Fresh and Hardened Concrete – Mix Design – BIS Method.	9
III	**CONSTRUCTION PRACTICES AND SAFETY** Loads acting on buildings – Site Clearance – Marking – Earthwork - Masonry – Stone and Brick – Flooring – Damp Proof Courses - Construction joints – Types – Building Foundationsand Basements - Formwork and scaffolding – Slip form technology – Construction Safety- Personal Protective Equipment (PPE) – Electrical Safety – Fire Prevention and Control – Safety Signs and Signals – Excavations and Confined Spaces.	9
IV	**SUB STRUCTURE ANDSUPER STRUCTURE CONSTRUCTION** Box jacking – Piling techniques – Tunnel driving – Cofferdam – Cable anchoring and methods in grouting – well point system and dewatering techniques – under water construction of diaphragm walls and basement – Tall structures – Chimneys, cooling towers, electric towers – Erection of articulated structures – Braced domes and space decks – Bridges and types – Construction methods and techniques using in-situ concrete and precast concrete.	9
V	**CONSTRUCTION EQUIPMENTS** Selection of Equipment for Earthwork – Earth Moving Operations – Types of Earthwork equipment – Tractors, Motor Graders, Scrapers, Front End Waders, Earth Movers – Equipment for Foundation and Pile Driving – Equipment for Compaction, Batching, Mixing and Concreting – Equipment for Material Handling and Erection of Structures – Equipment for Dredging, Trenching and Tunneling.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students will have ability to

CO1. Identify the typical and potential applications and properties of materials.
CO2. Test the concrete materials and determine the properties of fresh and hardened concrete.
CO3. Recognize codal provisions and incorporate safety practices in construction industry.
CO4. Plan the requirements for sub-structure and super-structure construction.
CO5. Enumerate the various equipments used in construction.

TEXT BOOKS:

T1 - Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd., 2008.
T2 -Arora S.P. and Brindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.

REFERENCE BOOKS:

R1 -Gambhir, M.L., Neha Jamwal" Building Materials – Products, Properties and Systems", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2013.
R2 -Duggal,S.K., "Building Materials", 4th Edition, New Age International, 2012.
R3- Sandeep Mantri, "Practical Building Construction and its Management", Satya Prakashan, New Delhi, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3204	SURVEYING –I	3	0	0	3

Course Objective

1. To gain knowledge on basic principle and concepts of different surveying methods.
2. To learn how to use compass to carryout land surveying.
3. To learn the basics of leveling and its applications.
4. To explore the principles for computation of areas using different methods.
5. To understand the concepts of Theodolite survey in linear and angular measurements.

Unit	Description	Instructional Hours
	INTRODUCTION AND CHAIN SURVEYING	
I	**INTRODUCTION:** Definition, objectives, principles and classification of surveying – Plan and map. Overview of Plane surveying (chain and compass), Objectives - Well conditioned triangles **CHAIN SURVEYING:** Linear measurements - Direct measurement – Ranging – offsets - errors in chaining-cross staff and optical square - obstacles in chaining - Problems - Traversing - plotting–Sources and limits of error and their correction.	9
	COMPASS SURVEYING	
II	Introduction, Meridians and bearings, Principle, working and use of Prismatic compass, Surveyor's compass. Dip and Declination, Traverse surveying, Computation of bearings and included angles given the bearings of legs of a closed traverse. Local attraction, determination and corrections.	9
	LEVELLING	
III	Levelling Instruments – Spirit Level – Sensitiveness – Bench Marks – Temporary and Permanent Adjustments – Differential, Fly,Check,Profile and Block Levelling – Booking - Rise and fall method and Height of Instrument method, comparison of Arithmetic checks - Reduction-CONTOURING: Definition of contour – Contour interval – Characteristics of contours – Direct and indirect methods of contouring – Applications of contour maps.	9
	COMPUTATION OF AREAS AND VOLUMES	
IV	Area from field notes and from plan by dividing into triangles, square etc. computation of areas along boundaries using Simpon's rule, and their comparison, computation of areas using planimeter, construction and working of planimeter. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.	9
	THEODOLITE SURVEYING	
V	Theodolite - vernier and micro-optic - description and uses - temporary and permanent adjustments - horizontal - vertical angles - heights and distances - Tangential and Stadia Tacheometry – Subtense method - Stadia constants - traversing - closing error and distribution - Gale's table - omitted measurements.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Carryout preliminarysurveying to prepare a layout of a given area.
CO2: Apply compass surveying and compute bearings.
CO3: Plot LS, CS and Contouring using leveling applications.
CO4: Compute the areas and distances using linear methods.
CO5: Apply the methods of measurement by heights and distances using tacheometry surveying.

TEXT BOOKS:

T1 - Punmia, B. C., "Surveying", Vol.1, Laxmi Publications, New Delhi. 2015
T2 - Chandra A.M., "Plane Surveying", New Age International Publishers, 2015.

REFERENCE BOOKS:

R1 -Alak De, "Plane Surveying", S. Chand & Company Ltd., 2000.
R2 - Bannister and S. Raymond, R. Baker "Surveying", 7th Edition, Pearson Education Ltd.,2009.
R3 - Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3205	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	3

Course Objective

1. To learn the concepts of ecosystem and inculcate a sense of responsibility in protecting our ecosystems.
2. To understand the natural resources.
3. To study the causes, effects and control measures of environmental pollution.
4. To gain the basic knowledge on social issues and the environment.
5. To emphasize the relationship between human population and the environment.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Environment - Definition, importance , components - concept of an ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – food chains, food webs and ecological pyramids – Biogeochemical cycles - Types, Characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, lakes, rivers, oceans, estuaries) – Ecological succession - Introduction to biodiversity - definition: genetic, species and ecosystem diversity – values and importance of biodiversity - hotspots of biodiversity - biogeographical classification of India – endangered and endemic species - threats to biodiversity – conservation of biodiversity: In-situ and ex- situ conservation of biodiversity.	12
II	**NATURAL RESOURCES** Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction– Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, soil erosion and desertification – role of an individual in conservation of natural resources.	10
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Thermal pollution (f) Radioactive pollution – Solid waste Management– role of an individual in prevention of pollution – pollution case studies.	8
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization - environmental ethics: Issues andpossible solutions – climate change, global warming, acid rain, ozone layer depletion– wasteland reclamation – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards.	8
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth – population explosion – family welfare programme – Women and Child welfare - human rights – value education – HIV / AIDS – Environmental Impact Assessment - role of information technology in environment and human health – Case studies.	7
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students will have ability to

CO1: Predict the implications of anthropogenic activities on ecosystems and protect biodiversity.
CO2: Appreciate the values of natural resources and develop measures for restoration.
CO3: Devise means and methods for pollution prevention and control.
CO4: Illustrate the social issues and also have a thorough understanding of the environmental legislations.
CO5: Integrate human health and environment and compile environmental data using IT.

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TEXT BOOKS:

T1 -Deeksha Dave, S. S. Katewa., "Text Book of Environmental Studies", 2nd edition, Cengage LearningIndia Pvt. Ltd., Delhi , 2012.

T2 -Anubha Kaushik and C.P.Kaushik, "Environmental Science and Engineering", 3rd Edn New ageInternational Publishers, New Delhi , 2008.

REFERENCE BOOKS:

R1 - R.K.Trivedi, "Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards",Vol.I &II, Environ Media., 2008.

R2 - G.Tyler Miller,JR, "Environmental Science", Tenth Edition, Thomson BROOKS/COLE ,2014.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3001	SURVEY LAB	0	0	4	2

Course Objective

1. To gain knowledge on the principles and usage of chains and its accessories.
2. To learn how to use compass.
3. To study the methods and operational techniques of levels and theodolite.

Expt . No.	Description of the Experiment
1.	Study of chains and its accessories
2.	Aligning, Ranging and Chaining
3.	Chain Traversing
4.	Compass Traversing
5.	Fly leveling using Dumpy level
6.	LS and CS
7.	Study of Theodolite
8.	Horizontal angle by the method of repetition
9.	Horizontal angle by the method of reiteration
10.	Measurement of vertical angle
11.	Theodolite traverse

Total Practical Hours **45**

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Handle and operate the conventional surveying instruments such as chain and tape to measure distances and areas.
CO2: Conduct traversing experiment using compass, and theodolite to calculate the given area.
CO3: Interpolate and plot LS, CS and Contour using levels.
CO4: Use the theodolite effectively to determine the horizontal and vertical angles.
CO5: Take measurements, adjust the errors and prepare a layout of a given area

REFERENCE BOOKS:

R1 - James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, 7th Edition, McGraw Hill, 2001.
R2 - Arora K.R., Surveying Vol I & II, Standard Book house , 10th Edition 2010
R3 - Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3002	COMPUTER AIDED BUILDING DRAWING	0	0	4	2

Course Objective

1. To review the basic commands options and elements of AutoCAD.
2. To read and understand the plan, elevation, cross section and joinery details of a building
3. To learn how to draw the various types of masonry, concrete and steel structures using AutoCAD.

Expt . No.	Description of the Experiment
1.	Masonry bonds and its types
2.	Principles of planning, dimensions and orientation of buildings as per NBC guidelines
3.	Joinery details (Paneled and Glazed Doors and Windows)
4.	Buildings with load bearing walls
5.	Buildings with sloping roof
6.	R.C.C. framed structures
7.	Industrial buildings – North light roof structures
8.	Building Information Modeling

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Draft the plan, elevation and cross-sectional views of various kinds of structures using computer applications.
CO2: Incorporate the principles of planning and orientation while plotting the layout of a building.
CO3: Sketch and label the various components of buildings and joinery details using AutoCAD.
CO4: Prepare detailed layouts of RCC and steel structures in accordance to NBC guidelines.
CO5: Efficiently plan and design buildings using BIM process.

TEXT BOOKS:

T1 - Sikka V. B., A Course in Civil Engineering Drawing, 4th Edition, S.K. Kataria and Sons, 2015.
T2 - George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002.

REFERENCE BOOKS:

R1 -Shah. M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Built Environment", Tata McGraw Hill Publishers Limited, 2011.
R2 - Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA4110	APPLIED PROBABILITY AND STATISTICS (B.E CIVIL)	3	1	0	3

Course Objective

1. Provide the fundamental knowledge of the concepts of probability.
2. Express the knowledge of standard distributions which can describe real life phenomenon.
3. Interpret mathematical support in real life problems and develop probabilistic models whichcan be used in several areas of science and engineering.
4. Provide the necessary basic concepts of some statistical methods.
5. Manipulate different kinds of problems occurring in engineering and technology by applying the design of experiments.

Unit	Description	Instructional Hours
I	**PROBABILITY AND RANDOM VARIABLE** Introduction - Conditional probability- Total probability- Baye's theorem(proof excluded) - Random variable - Discrete and Continuous random variables– Moment generating functions.	9
II	**STANDARD DISTRIBUTIONS** Discrete distributions – Binomial, Poisson, Geometric distributions – Continuous distributions – Uniform, exponential and Normal distributions.	9
III	**TWO DIMENSIONAL RANDOM VARIABLES** Joint distributions – discrete and continuous random variables - Marginal and Conditional probabilitydistributions – Covariance – Correlation.	9
IV	**TESTING OF HYPOTHESIS** Large sample test based on Normal distribution for single mean and difference of means, Tests based on t (single mean and difference of means) - Chi-Square test– Goodness of fit.	9
V	**DESIGN OF EXPERIMENTS (ANOVA)** One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Have a fundamental knowledge of the probability concepts.
CO2:Acquire knowledge of standard distributions.
CO3: Understand the concept of two dimensional random variables, Correlation.
CO4: Acquire skills in analyzing statistical methods.
CO5: Have a clear perception of the statistical ideas and demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

T1 - Gupta, S.C., & Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, Reprint 2011
T2 - Veerarajan.T," Probability, Statistics and Random Process",Tata McGraw Hill,2nd Edition,New Delhi, 2010

REFERENCE BOOKS :

R1-Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, RandomVariables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
R2 -Walpole. R.E., Myers. R.H., Myers. S.L., & Ye K.,"Probability & Statistics for Engineers & Scientists", 8th Edition, Pearson Education, Asia, 2007.
R3 -Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4201	STRENGTH OF MATERIALS	3	1	0	4

Course Objective

1. To know the concepts of truss analysis.
2. To gain knowledge on the analysis of thin and thick cylinders subjected to fluid pressure and various failure theories.
3. To study the behaviour of short and long column under axial and eccentric loads.
4. To understand the deflection of beams by various methods.
5. To get exposed to the principles of unsymmetrical bending and shear.

Unit	Description	Instructional Hours
	ANALYSIS OF TRUSSES	
I	Perfect, deficient and redundant trusses - Degree of redundancy – Internal and external redundancy – Methods of analysis - Method of joints - Method of sections - Method of tension coefficients - Analysis of Space Truss.	9+3
	THIN AND THICK CYLINDERS AND THEORIES OF ELASTIC FAILURE	
II	Thin cylinders – Circumferential stress – Longitudinal stress – Volumetric strain -Stresses in thick cylindrical shell– Lame's equation – Stresses in compound cylinders – Shrink fit - Failure theories - Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- Strain energy theory- maximum shear strain energy theory.	9+3
	COLUMNS AND STRUTS	
III	Short and slender columns- Axial and bending stress – Kern of a section - buckling and stability – Columns with pinned ends - Columns with other support conditions - Columns with eccentric loads - Euler theory and Rankine's formula - Elastic and inelastic column behaviour – Design formulae for columns.	9+3
	DEFLECTION OF BEAMS	
IV	Deflection of beams - Geometric methods - Double integration method – Macaulay's method – Moment-Area method - Conjugate beam method.	9+3
	UNSYMMETRICAL BENDING	
V	Unsymmetrical bending- Symmetrical and unsymmetrical sections - Bending stresses in beams - Shear centre - Shear centre for thin walled beam of mono- Symmetric and unsymmetrical open sections.	9+3
	Total Instructional Hours	**45+15=60**

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Analyse the determinate trusses.
CO2: Evaluate the problems related to thin and thick cylinders subjected to fluid pressure.
CO3: Interpret the behaviour of short and long column under axial and eccentric loads.
CO4: Determine slope and deflection in beams using various methods.
CO5: Apply the concepts in beams subjected to unsymmetrical bending.

TEXT BOOKS:

T1-Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand&Company Ltd., New Delhi, 2015.
T-2 Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1- Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2006.
R2- PunmiaB.C. "Theory of Structures" (SMTS) Vol 1&II, Laxmi Publishing Pvt. Ltd., New Delhi 2018.
R3- Srinath, L.S, "Advanced Mechanics and solids", Tata-McGraw Hill publishing company Ltd, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4202	APPLIED HYDRAULICS AND HYDRAULICMACHINERY	3	0	0	3

Course Objective

1. To understand the types and flow regimes of open channel flows.
2. To get acquainted with velocity measurements and determine the most economical channel sections.
3. To acquire knowledge on the concepts of varied flow and learn the characteristics of hydraulic jump.
4. To learn the various types of turbines and calculate the work done by each.
5. To study the different types of pumps and their performance.

Unit	Description	Instructional Hours
	OPEN CHANNEL FLOW	
I	Open channel flow - Types and regimes of flow - Velocity distribution in open channel - Wide open channel -Specific energy -Critical flow and its computation - channel transition.	8
	UNIFORM FLOW	
II	Uniform flow -Velocity measurement - Manning's and Chezy's formula - Determination of roughness coefficients - Determination of normal depth and velocity - Most economicalsections - Non-erodible channels.	8
	VARIED FLOW	
III	Dynamic equations of gradually varied flow - Assumptions - Characteristics of flow profiles - Draw down and back water curves - Profile determination - Graphical integration, direct step and standard step method - Flow through transitions – Hydraulic jump – Types - Energy dissipation – Surges.	9
	TURBINES	
IV	Impact of Jet on vanes - Turbines - Classification – Velocity triangle - Governing and selection of turbine - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine -Specific speed - Similarity laws.	10
	PUMPS	
V	Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.	10
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Classify open channel flows and plot the flow regimes.
CO2:Design the most economical sections for open channel flows.
CO3:Analyse varied flows and interpret hydraulic jump phenomenon.
CO4:Assess the performance of various types of turbines.
CO5:Estimate the efficiency of different pumps.

TEXT BOOKS:

T1 - Chandramouli 'Applied Hydraulics' YesDee Publishers, 2017
T2 - R.K.Rajput., "A text Book of Fluid Mechanics", S.Chand and Company,New Delhi,2009.

REFERENCE BOOKS:

R1 - Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2011.
R2- Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
R3 -Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4203	SOIL MECHANICS	3	0	0	3

Course Objective

1. Learn the soil classification and compaction behavior of soil.
2. Study the concepts behind the effective stress, permeability and seepage of soil.
3. Understand the concepts of stress distribution and settlement.
4. Explore the principles of shear test and liquefaction.
5. Gain knowledge on slope stability analysis, failure mechanism and protection measures.

Unit	Description	Instructional Hours
	SOIL CLASSIFICATION AND COMPACTION	
I	Nature of soil - Soil formation - Soil water – phase relationship - Volume-weight relationships - Index properties of soils - BIS Classification system – Tests for specific gravity -Grain size distribution – Sieve analysis – Atterberg limits - Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.	9
	EFFECTIVE STRESS CONCEPTS AND PERMEABILITY	
II	Effective stress concepts in soils – quick sand condition - Critical hydraulic gradient - Permeability measurement in the laboratory – Constant head and Variable head method - factors influencing permeability of soils - Seepage – introduction to flow nets – properties and uses of flow nets - Equipotential and flow lines - Simple problems.	9
	STRESS DISTRIBUTION AND SETTLEMENT	
III	Stress distribution - soil media – Boussinesq equation – point load and line load - Wester-gaard's equation - Components of settlement — immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – computation of rate of settlement - $\sqrt{t}$ and log t methods - Factors influencing compression behavior of soils.	9
	SHEAR STRENGTH	
IV	Shear strength of cohesive and cohesion less soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – cyclic mobility – Liquefaction.	9
	SLOPE STABILITY	
V	Slope failure mechanisms – Types of slope failure – stability analysis for cohesive andcohesion less soil - Friction circle method – Method of slices - Use of stability number - slope protection measures.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Classify the soil based on index properties of soil.

CO2:Assess the permeability characteristics of soil and calculate stress at any point in soil media due to load applied at a ground surface.

CO3:Identify the stress distribution in soil, settlement problems occur in construction site.

CO4:Applythe knowledge in carrying out soil testing.

CO5:Analyze the stability of slope in cohesive and cohesion less soil by using different methods.

TEXT BOOKS:

T1-Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2015.

T2- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd.,New Delhi. 2011.

REFERENCE BOOKS:

R1 –Purusothamaraj.P "Soil mechanics and FoundationEngineering" 2nd Edition, Pearson Education, 2013.

R2 - Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2017.

R3 - Palanikumar. M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Leaning Private Limited, Delhi, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4204	SURVEYING II	3	0	0	3

Course Objective

1. To understand the fundamentals of Control Surveying
2. To be conversant with the precautionary measures and corrections in surveying.
3. To learn the principles of Curve ranging
4. To acquire knowledge on working principle of EDM and Total Station
5. To study the principles of GPS and GIS and gain knowledge on aerial photography

Unit	Description	Instructional Hours
	CONTROL SURVEYING	
I	Vertical and horizontal control-Triangulation – DifferentNetworks, Orders and Accuracies.Signals and Towers, Trilateration, Base line-Instruments and Accessories-Corrections-Satellite stations- Reduction to centre-Trignometric leveling-Singleand reciprocal observations.	9
	SURVEY ADJUSTMENTS	
II	Errors-Sources, Precautions and corrections-Classification of errors-true and most probable values- Weighted observations- Method of equal shifts-Principle of least squares-Level nets-Normal equations-Correlates.	9
	CURVES	
III	Introduction - Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite – Compound curves - Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances.	9
	ELECTRONIC DISTANCE MEASUREMENTS	
IV	Measurement principle of EDM instrument – EDM instrument characteristics – Accuracy in EDM – Field procedure of EDM – Total station – Introduction – Advantages – Types of total stations – Applications of total station - Sources of Error - Care and maintenance of Total Station instruments	9
	GEOGRAPHICAL INFORMATION SYSTEM	
V	Introduction – Maps – Map projections – Map analysis – GIS – Definition – Basic components of GIS - Standard GIS softwares – Data types – Spatial and non-spatial (attributed) data – Measurement scales – Data Base Management Systems (DBMS).	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have ability to
CO1 - Employ various types of Control Surveying.
CO2 - Take suitableprecautions and apply necessary corrections in surveying.
CO3 - Interpret and plot simple, compound and transition curves
CO4 - Apply principles of EDM and use total stationin surveying
CO5 - Plot and analyze the profile of various Photogrammetric mechanisms.

TEXT BOOKS:

T1 - Duggal S.K , "Surveying" ,Vol. I &II , Tata McGraw-Hill, Publishing Company,2017.
T2 - Punmia.B.C., "Surveying Volume-1 & Volume-2", ",Laxmi Publications(p)Ltd.,2016.

REFERENCE BOOKS:

R1 -Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 4th Edition, 2015.
R2 -Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4205	HIGHWAY AND RAILWAY ENGINEERING	3	0	0	3

Course Objective

1. To familiarize the concepts of highway planning and geometric design of highway.
2. To learn the design of pavements.
3. To get exposed to various highway materials and testing, maintenance and pavement evaluation.
4. To know the importance of proper planning, designing and signaling of railways.
5. To understand the necessity of railway maintenance and modernization of tracks.

Unit	Description	Instructional Hours
I	**HIGHWAY PLANNING AND ALIGNMENT** Historical Development of Road Construction – Highway Development in India – Institutions for Highway Development at National Level – Requirements and Factors Affecting of Ideal Road Alignment – Engineering Survey for Alignment(Conventional & Modern Methods) – Classification of Roads – Highway cross sectional elements – Sight Distance – Design of Horizontal Alignments – Super elevation, Widening of pavements on horizontal curves – Transition Curves – Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves.	9
II	**PAVEMENT DESIGN AND HIGHWAY CONSTRUCTION** Rigid and Flexible Pavements – Components and their functions – Design principles ofFlexible and Rigid Pavements, Factors affecting the Design of Pavements – ESWL, Climate, Sub-grade Soil and Traffic – Design Practice for Flexible and Rigid Pavements (CBRMethod, IRC Method and Recommendations – Problems) –Joints.	9
III	**HIGHWAY MATERIALS, MAINTENANCE AND REHABILITATION** Desirable Properties and Testing of Highway Materials – CBR Test, Field Density Test – Aggregate – Crushing, Abrasion, Impact Tests, Water Absorption, Flakiness and Elongation Indices – Bitumen – Penetration, Ductility, Viscosity, Binder Content and Softening Point Test – Construction Practices – Water Bound Macadam Road, Wet mix macadam road Bituminous Road and Cement Concrete Road – Pavement distress in Flexible and Rigid Pavements – Symptoms, Causes and Treatments – Special Repairs – Highway Drainage – Pavement Evaluation – Pavement Strengthening – Overlay design by Benkelman Beam Method(Procedure Only).	9
IV	**RAILWAY PLANNING AND DESIGN** Role of Indian Railways in Development of Nation – Engineering Surveys for track alignment – Conventional and modern methods (Remote Sensing, GIS & GPS etc) – Elements of permanent way – Rails, sleepers, Ballast, rail fixtures and fastenings – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods – Geometric design of railways, gradient, super elevation, widening of gauge on curves – Points and Crossings.	10
V	**RAILWAY CONSTRUCTION AND MAINTENANCE** Earth work – Stabilization of track on poor soil – Tunneling methods, drainage and ventilation – Calculation of Materials required for track laying – Construction and maintenance of tracks Modern methods of construction & maintenances – Railway stations and yards and passenger amenities – Urban rail – Infrastructure for Metro, Mono and underground railways – Introduction of hyper loop.	8
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Understand different highway development programs, sight distance and IRC recommendations.
CO2. Design the flexible and rigid pavements by IRC method.
CO3. Identify and explain the various highway materials and pavement evaluation methods.
CO4. Plan and design of railway tracks.
CO5. Demonstrate the need for modernization of tracks for speed trains.

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TEXT BOOKS:

T1- S K Khanna and C E G Justo, "Highway Engineering", Nem Chand and Brothers, Roorkee, 2015

T2- SaxenaSubhash C and Satyapal Arora, "A Text book of Railway Engineering", Dhanpat Rai andn Sons, Delhi, 2010.

REFERENCE BOOKS:

R1- S.P. Bindra, " Highway Engineering", Dhanpat Rai and Sons, Delhi,2014.

R2- L R Kadiyali, Principles and Practice of Highway Engineering, Khanna Publishers, Delhi,2005.

R3- G.V. Rao , "Principles of Transportation Engineering",Tata McGraw Hill Publication,2017.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4001	STRENGTH OF MATERIALS LAB	0	0	4	2

Course Objective

1. Understand the mechanical properties of materials used in construction.
2. Study the behavior of metals under the action of various forces.
3. Learn the various test procedures carried out on cement, bricks, metals and timber.

Expt . No.	Description of the Experiment
1.	Tension test on mild steel rod and aluminum rod.
2.	Torsion test on mild steel rod.
3.	Double shear test on mild steel rod and aluminum rod.
4.	Impact test on metal specimens (Izod and Charpy)
5.	Rockwell hardness test on metals.
6.	Brinnel hardness test on metals.
7.	Deflection test on metal beam.
8.	Test on helical spring.
9.	Compressive test on wooden cube (Parallel and Perpendicular)
10.	Compressive test on brick
11.	Normal Consistency test of cement.
12.	Fineness of cement.
13.	Setting time of cement.
14.	Soundness test on cement.
15.	Specific gravity of cement.

Total Practical Hours 45

Course Outcome

CO1. Determine the tensile, torsion, shear strength, hardness and impact values of metal specimens.
CO2. Carry out deflection test on metal beams.
CO3. Conduct experiments to calculate the compression strength of timber and bricks.
CO4. Assess the various physical and mechanical properties of cement.
CO5. Evaluate and justify the suitability of construction materials based on test results.

REFERENCE BOOKS:

R1- Strength of Materials Laboratory Manual, Anna University, Chennai – 600 025.
R2- IS 1786-2008, Specification for cold worked steel high strength deformed bars for concrete reinforcement, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4002	FLUID MECHANICS AND HYDRAULIC MACHINERY LAB	0	0	4	2

Course Objective

1. To understand the theories and principles governing the flow using experimental methods.
2. To learn how to determine the various losses occurring in pipes.
3. To study the characteristics of pumps and turbines.

Expt . No.	Description of the Experiment
	FLOW MEASUREMENT
1.	Flow through Venturimeter, Orificemeter
2.	Flow through variable duct area - Bernoulli"s Experiment
3.	Flow through Orifice, Mouthpiece and Notches
	LOSSES IN PIPES
4.	Determination of friction coefficient in pipes
5.	Determination of loss coefficients for pipe fittings
	PUMPS
6.	Characteristics of Centrifugal pumps
7.	Characteristics of Gear pump
8.	Characteristics of Submersible pump
9.	Characteristics of Reciprocating pump
	TURBINES
10.	Characteristics of Pelton wheel turbine
11.	Characteristics of Francis turbine
12.	Characteristics of Kaplan turbine
13.	Determination of Metacentric height (Demonstration)

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Measure discharge in pipes and channels.
CO2: Determine the major and minor losses in pipes and conduits.
CO3: Demonstrate and plot the characteristic curves of pumps and turbines.
CO4: Calibrate various instruments and accessories used to measure the flow properties.
CO5: Employ the theories and principles governing the flow while designing water supply, drainage and plumbing systems.

REFERENCES:

R1 - Sarbjit Singh. "Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2012.
R2 – "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
R3 - Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
	16CE5201	STRUCTURAL ANALYSIS - I	3	1	0	4

Course Objective

1. To gain the knowledge on computing slopes and deflections using energy methods.
2. To learn about basic concepts in influence lines for statically determinate and indeterminate structures.
3. To solve arched and cable profiled structures.
4. To analyze the indeterminate structures for internal forces by theorem of three moments and slope deflection method.
5. To calculate the internal forces on indeterminate structures by moment distribution method.

Unit	Description	Instructional Hours
	WORK–ENERGY METHODS AND INDETERMINATE TRUSSES	
I	Work - Principle of virtual work - Deflections of trusses, beams and frames -Conservation of energy and strain energy – Castigliano's second theorem - Betti's law and Maxwell's reciprocal theorem. Analysis of indeterminate trusses by consistent deformation method.	9+3
	MOVING LOADS AND INFLUENCE LINES	
II	Influence lines for reactions in statically determinate structures – influence lines for member forces in pin-jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads - Muller Breslau's principle – Influence lines for continuous beams and single storey rigid frames.	**9+3**
	ARCHES	
III	Arches as structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches – Settlement and temperature effects.	9+3
	INDETERMINATE BEAMS AND FRAMES	
IV	Theorem of three Moments equation - Fixed and propped cantilever - Derivation of slope deflection equation - Analysis of statically indeterminate beams and portal frames – Continuous beams with and without support yielding – Analysis of portal frames with and without sway.	**9+3**
	MOMENT DISTRIBUTION METHOD	
V	Distribution and carryover of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway – Neylors simplification.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Determine slopes and deflections of beams and frames.
CO2: Draw influence lines for statically determinate and indeterminate structures.
CO3: Analyse and solve arched and cable profiled structures.
CO4: Evaluate the problems related to the indeterminate structures by exact analysis.
CO5: Apply the concepts in indeterminate structures by iterative procedure.

TEXT BOOKS:

T1-Vaidyanathan, R. and Perumal, P., "Structural Analysis – Vol.I & II", Laxmi Publications, New Delhi, 2016.
T2-Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 2004.

REFERENCE BOOKS:

R1-Wang C.K. , "Indeterminate Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi,2010.
R2-Ghali.A., Nebille and Brown. T.G., "Structural Analysis - A unified classical and matrix approach" Sixth Edition, SPON press, New York, 2013.
R3- NegiL.S. & JangidR.S, "Structural Analysis", Tata McGraw Hill Publications, New Delhi, 6th Edition,2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5202	DESIGN OF RCC ELEMENTS	3	0	0	3

Course Objective

1. To learn the various methods of design and understand the basic concepts of design of flexural members and slabs by working stress method.
2. To understand the basic concepts and steps in the design of beams and slabs by limit state method.
3. To learn the design principles of RC members in bond, shear and torsion by limit state method.
4. To understand the concepts in the design of RC Column design by limit state method.
5. To gain knowledge on the concept of RC footings design by limit state method.

Unit	Description	Instructional Hours
I	**WORKING STRESS METHOD OF DESIGN** Stages in structural design - Structural planning - Design philosophies - Working stress method - Ultimate load method - Limit state method - Characteristic strength - Characteristic load - Design values - Partial safety factors - Codal provisions - Practical aspects of design - Design of flexural members and slabs by working stress method.	9
II	**LIMIT STATE DESIGN FOR FLEXURE** Analysis and design - One way and two way slabs – Singly and doubly reinforced rectangular and flanged beams - Cantilever beams - Standard method of detailing of RC beams and slabs.	9
III	**LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR AND TORSION** Behaviour of RC members in bond and anchorage – Curtailment of reinforcement - Design requirements as per code provision – Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion.	9
IV	**LIMIT STATE DESIGN OF COLUMNS** Columns – Assumptions – Effective length – Classification – Design guidelines – Axially loaded short columns with lateral ties and helical reinforcement – Columns subjected to uni-axial bending and biaxial bending - Standard method of detailing of RC columns.	9
V	**LIMIT STATE DESIGN OF FOOTING** Introduction and selection of footing under different site conditions - Design of wall footing – Design of axially and eccentrically loaded rectangular footing – Combined footing - Standard method of detailing of RC footing..	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Distinguish the various design methods and also design.
CO2: Design flexural members using limit state method under different loading and end conditions.
CO3: Design flexural members for shear, bond, and torsion using limit state method.
CO4: Design RC columns with different end conditions using limit state method.
CO5: Select and design RC footing under various site conditions using limit state method.

TEXT BOOKS:

T1 -Punmia, B. C ,Ashok Kumar Jain, Arun Kumar Jain "Limit State Design of Reinforced Concrete", LaxmiPublications (P) Ltd, New Delhi , 2007.
T2 -Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing CompanyLtd., New Delhi , 2016.

REFERENCE BOOKS:

R1 -Sinha, S.N., "Handbook of Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
R2 -Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., NewDelhi ,2008.
R3 -Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi, 2016.

CODE BOOKS:

C1 - IS 456-2000: Plain and Reinforced Concrete - Code of Practice.
C2-SP 16: Design Aids for Reinforced Concrete to IS 456:2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5203	DESIGN OF STEEL STRUCTURES	3	0	0	3

Course Objective

1. To understand the concept of Limit State design and design of connections.
2. To gain knowledge on design of tension members.
3. To study the design of compression members.
4. To get familiar with beamsdesign.
5. To learn the design of industrial structures

Unit	Description	Instructional Hours
	DESIGN OF CONNECTIONS	
I	Structural steel sections –Limit state design concepts-Connections-bolted and welded joints - Failure of joints -Efficiency of joints -Eccentric connections.	9
	TENSION MEMBERS	
II	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.	9
	COMPRESSION MEMBERS	
III	Types of compression members – Theory of columns – Basics of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns – Design of column bases – Gusseted base.	9
	BEAMS	
IV	Design of laterally supported and unsupported beams –Built up beams –design of Plate Girders –Intermediate and bearing stiffeners –Web splicing.	9
	INDUSTRIAL STRUCTURES	
V	Design of roof trusses –Elements of roof trusses –Design of purlins –Estimation of wind loads –Design of gantry girders.	9
	Total Instructional Hours	45

Course Outcomes

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

CO1: Gain knowledge on the limit state concepts design and connections.
CO2: Design tension members.
CO3: Design compression members.
CO4: Design beams, plate girders, stiffeners and web splice.
CO5: Design components of steel trusses, purlins and gantry girders.

TEXT BOOKS:

T1 – Subramanian. N , "Design of Steel Structures: Theory and Practice" , Oxford Publications, 2011.T2 - Duggal S. K. , "Design of Steel Structures", Tata McGraw-Hill Education, 2017

REFERENCE BOOKS:

R1 –Bhavikatti S.S. , "Design of Steel Structures", I. K. International Pvt Ltd. , 2017.
R2 -Negi L.S. "Design of Steel Structures", Tata McGraw - Hill Publishing Pvt Ltd., New Delhi, 2008.R3 -Gaylord, E.H., Gaylord, N.C., and Stallmeyer, J.E., "Design of Steel Structures", McGraw-Hill Publications, 2010.

CODE BOOKS:

C1 - IS 800 (2007): General Construction In Steel - Code of Practice [CED 7: Structural Engineering and structural sections.
C2 - SP (6) - ISI Handbook for Structural Engineers – Structural Steel Sections (1964).
C3 - IS 875 (part – 3) 1987 (Wind Loads) Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures.
C4 - Murugesan . R & ArulmanickamA.P., "Steel Tables (S.I. Units)-(Fifth Edition)", Pratheeba Publishers, 2009

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5204	WATER SUPPLY ENGINEERING	3	0	0	3

Course Objective

1. Gain knowledge on the characteristics of water, water quality standards and plan water supply system based on demand and rate of consumption.
2. Acquire adequate information on the conveyance system and its components.
3. Learn the unit operations and understand the design of various components of water treatment plants.
4. Explore the various advanced water treatment methods.
5. Get conversant with the methods of water distribution, systems of plumbing and house service connections.

Unit	Description	Instructional Hours
	PLANNING OF WATER SUPPLY SYSTEM	
I	Public water supply system – Objectives – Planning – Design period – Physical, chemical and biological characteristics of water – IS and WHO standards – Water demand - Types of demand – Variations in demand – Population forecasting .	9
	CONVEYANCE	
II	Sources of water – Surface and groundwater sources- Well hydraulics - Intakes – Pipes and conduits for conveying water – Pipe hydraulics – Pipe materials – Laying, joining and testing of pipes – Pipe appurtenances – Pumps and pumping stations.	9
	WATER TREATMENT	
III	Objectives – Unit operation and processes – Screens, Principles & functions of chemical feeding, flash mixers, flocculators, sedimentation tanks and sand filters – Disinfection – Residue management – Construction, operation and maintenance of water treatment plants	10
	ADVANCED WATER TREATMENT	
IV	Principles and functions of aeration – Iron and manganese removal – Defluoridation and demineralisation – Water softening – Desalination - Membrane systems – Recent advances.	8
	WATER DISTRIBUTION AND SUPPLY TO BUILDINGS	
V	Requirements of water distribution - Distribution systems – Analysis of distribution networks – Computer applications – Leak detection methods - Principles of design of water supply to buildings – House service connections – Fixtures and fittings – Systems of plumbing - types of plumbing.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have the ability to

CO1: Understand the importance of water quality standards and forecast population to determine the rate of consumption

CO2: Classify the sources of water and illustrate the structure of collection and conveyance systems.

CO3: Classify and design the various components of the water treatment plant.

CO4: Evaluate and recommend the various advanced treatment methods based on the requirements.

CO5: Analyze distribution networks and assess the various systems of plumbing.

TEXT BOOKS:

T1. Punmia, B. C. , Ashok K Jain, and Arun K Jain, "Water Supply Engineering", Laxmi Publications, Pvt. Ltd., New Delhi, 2012.

T2. Garg, S. K, "Environmental Engineering" Vol. I, Khanna Publishers, New Delhi, 2010.

REFERENCE BOOKS:

R1. Birdie, G.S, and Birdie. J. S , "Water supply and Sanitary Engineering", DhanpatRai& Sons, 2010.

R2. Modi, P. N, "Water Supply Engineering" Vol.I, Standard Book House, New Delhi, 2010.

R3. Manual on Water Supply and Treatment – CPHEEO, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5205	FOUNDATION ENGINEERING	3	0	0	3

Course Objective

1. To understand various methods ofSite Investigation.
2. To study the behavior of shallow foundations.
3. To gain knowledge on types and proportioning of footing.
4. To study the types, functions and load carrying capacity of piles.
5. To learn the characteristics of Retaining walls.

Unit	Description	Instructional Hours
	SOIL EXPLORATION AND SITE INVESTIGATION	
I	Introduction of soil exploration-scope and objectives –Method of exploration – auguring and Boring – wash boring and Rotary drilling – Depth of Boring and Spacing of bore hole – Types of samples and sampling methods – split spoon sampler – Piston sampler- Penetration test (SPT and SCPT) -Site investigation Reports.	9
	SHALLOW FOUNDATIONS AND SETTLEMENT	
II	Introduction – Location and depth of foundation– Codal provisions -Bearing capacity of shallow foundation on homogeneous deposit - Terzaghi's formula and BIS formula - Bearing capacity factors - Allowable bearing capacity –Bearing capacity from plate load test Determination of settlement of foundation on granular and clay deposits - Total and Differential settlement – Method of minimizing total and differential settlements.	9
	FOOTINGS AND RAFT	
III	Types of footings – contact pressure distribution: Isolated footing – combined footing – Types and proportioning – Mat foundation – Types and proportioning – Floating foundation – Seismic force consideration.	9
	PILE FOUNDATION	
IV	Types of piles and their function - Load carrying capacity of single pile - Static & Dynamic formulae (Engineering News and Hileys) - Pile load tests - Negative skin friction –Group capacity by different methods (Felds rule, Converse Labarre formula and block failure criterion) – Settlement of pile group - Under reamed piles – Capacityunder compression and uplift	9
	RETAINING WALLS	
V	Plastic equilibrium in soil - Active and passive states - Rankin's theory – cohesionless and cohesive soil - Coulomb's wedge theory –Earth pressure on retaining walls of simple configuration –Culmann's graphical method - Rebhann's graphical method - stability analysis of retaining wall.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have ability to

CO1: Select the suitable method ofSite Investigation based on the soil condition.
CO2: Calculate the Bearing Capacity and settlement of shallow foundation.
CO3: Comprehend the types and proportioning of footing.
CO4: Estimate the pile load capacity
CO5: Understand Retaining wall failure mechanisms and Stability of retaining walls.

TEXT BOOKS:

T1 - Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2004.

T2 - Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2011.

REFERENCE BOOKS:

R1 –Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013.

R2 - Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2012.

R3 - Punmia, B.C. " Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2017.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5001	SOIL MECHANICS LABORATORY	0	0	4	2

Course Objective

1. Understand the characteristics of soil and study their behaviour under the influence of various forces using experimental methods.
2. Learn the various tests carried out to measure the index properties, density and compaction characteristics of the soil sample
3. Get conversant with the test procedures to determine the engineering properties of soil.

Expt. No.	Description of the Experiment
I.	**DETERMINATION OF INDEX PROPERTIES OF SOIL**
1.	Specific gravity of soil solids
2.	Grain size distribution – Sieve analysis
3.	Grain size distribution Hydrometer analysis
4.	Consistency limits test (Liquid limit, Plastic limit and Shrinkage limits)
5.	Differential free swell tests for clay soil
II.	**DETERMINATION OF INSITU DENSITY AND COMPACTIONCHARACTERISTICS**
6.	Field density test (core cutter method and sand replacement method)
7.	Determination of moisture – density relationship using standard proctor compaction test
III.	**DETERMINATION OF ENGINEERING PROPERTIES OF SOIL**
8.	Direct shear test in cohesion less soil
9.	Laboratory vane shear test in cohesive soil
10.	Unconfined compression test in cohesive soil
11.	Laboratory permeability test (constant head and falling head methods)
12.	California bearing ratio test
13.	One dimensional consolidation test
14.	Tri-axial compression test (Demonstration only)

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Carry out specific field investigations to collect, test, observe and record the soil characteristics and its behavior.

CO2: Identify and classify soil based on standard geotechnical engineering practice.

CO3: Conduct tests to determine and demonstrate the index properties of soil.

CO4: Estimate compressive strength, shear strength, permeability and other engineering properties of soil

CO5: Assess and justify the suitability of soil for construction purposes based on test results.

REFERENCE BOOKS:

R1 - Braja. M Das ,"Soil Mechanics: Laboratory Manual" Oxford University Press , 2012.

R2 - Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) Limited Publishers, New Delhi, 2002.

R3 - Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5002	CONCRETE AND HIGHWAY LABORATORY	0	0	4	2

Course Objective

1. To study the properties of constituent materials, fresh concrete and mix design procedure.
2. To learn the tests on hardened concrete and how the different materials shall modify the performance of concrete.
3. To know the properties of bitumen and to study the various tests carried out on aggregates.

Expt . No.	Description of the Experiment
	TESTS ON AGGREGATES
1.	Specific Gravity of Aggregates
2.	Proportioning of Aggregates
3.	Water Absorption of Aggregate
4.	Flakiness Index and Elongation Index
5.	Crushing and Impact value
6.	Abrasion
	TESTS ON FRESH & HARDENED CONCRETE
7.	Slump Cone and Compaction Factor
8.	Flow Table and Vee Bee Consistometer
9.	Compressive Strength and Split Tensile Strength
10.	Flexural Strength and Modulus of Elasticity
	TEST ON BITUMEN
11.	Penetration and Softening Point
12.	Density and Specific Gravity
13.	Flash and Fire Point
14.	Viscosity and Ductility
15.	Marshall Stability and Flow value
16.	Bitumen Binder Content

Total Practical Hours **45**

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Prepare concrete mixes in accordance to BIS to achieve the target strength.
CO2: Carry out various tests to determine flow properties of fresh concrete
CO2: Conduct tests to demonstrate and determine the strength of hardened concrete.
CO4: Diagnose the properties of aggregates and bitumen using different testing methods.
CO5: Assess the quality of the various constituents of concrete and draw inferences from the test results.

REFERENCE BOOKS:

R1 - M.L.Gambhir, NehaJamwal, "Building and Construction Materials – Testing and Quality Control(LabManual)",McGraw Hill Education (India) Private Limited, New Delhi, 2014
R2 - M.S.Shetty, "Concrete Technology, Theory & Practice", S.Chand and Co, New Delhi, 2008.
R3 -Khanna,S.K, Justo,C.E.G."Highway material testing (LaboratoryManual)", NemChand& Bros, Roorkee (U.P), Revised Edition, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5003	SURVEY CAMP	0	0	0	1

Course Objective

1. Gain exposure to the triangulation, trilateration and tacheometric methods of surveying.
2. Study the methods of leveling to plot the profile and contour of a given area.
3. Learn the various techniques of setting simple, compound and transition curves.

Expt . No.	Description of the Experiment
1.	Stadia tacheometry
2.	Tangential tacheometry
3.	Simple curve by long chord method
4.	Simple curve by rankine's method
5.	Plane table surveying: Radiation
6.	Plane table surveying: Intersection
7.	Plane table surveying: Traversing
8.	Heights and distances by single and double plane method
9.	Setting out work
10.	Trilateration survey
11.	Triangulation survey
12.	Measurement of area by total station
13.	Grid contouring
14.	Radial contouring
15.	Determination of azimuth

Total Practical Hours **2 weeks**

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Employ the methods of triangulation and trilateration to measure the given area.
CO2: Conduct tacheometric surveying and calculate heights and distances between two or more points.
CO3: Set out simple, compound and transition curves using theodolite.
CO4: Interpolate and sketch a contour map of a given area.
CO5: Determine the azimuth of survey line by ex-meridian observation on the sun.

REFERENCE BOOKS:

R1- James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, 7th Edition, McGraw Hill, 2012.
R2- Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2010.
R3-Arora K.R., Surveying Vol I & II, Standard Book house, 11th Edition, 2010.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6201	STRUCTURAL ANALYSIS - II	3	1	0	4

Course Objective

1. To solve statically indeterminate structures by imposing boundary conditions on flexibility matrix.
2. To formulate the element stiffness matrix and assemble the structure stiffness matrix for solving indeterminate problems.
3. To study the basics of finite element method and its application to structural analysis.
4. To understand the importance of plastic analysis to calculate the collapse loads for beams and frames.
5. To learn about basic concepts for suspension bridges and space truss.

Unit	Description	Instructional Hours
I	FLEXIBILITY METHOD Equilibrium and compatibility – Determinate vs. Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).	9+3
II	**STIFFNESS METHOD** Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancy limited to two).	**9+3**
III	FINITE ELEMENT METHOD Introduction – Discretization of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements. PLASTIC ANALYSIS OF STRUCTURES Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.	9+3
V	SPACE AND CABLE STRUCTURES Analysis of Space trusses using method of tension coefficients – Beams curved in plan - Suspension cables – suspension bridges with two and three hinged stiffening girders.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Analyse the statically indeterminate structures using flexibility method.
CO2: Analyse the statically indeterminate structures using stiffness method.
CO3: Apply the finite element method to structural analysis.
CO4: Employ plastic analysis to calculate the collapse loads for beams and frames.
CO5: Evaluatethe member forces in suspension bridges and space truss.

TEXT BOOKS:

T1- Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures",Laxmi Publications, 2017.
T2-Vaidyanathan, R. and Perumal, P., "Structural Analysis – Vol.I & II", Laxmi Publications, New Delhi, 2016.

REFERENCE BOOKS:

R1- Gambhir. M.L., "Fundamentals of Structural Mechanics and Analysis" ,PHI Learning Pvt. Ltd., New Delhi, 2011.
R2- BhavaiKatti, S.S, "Structural Analysis – Vol. 1 and Vol. 2", Vikas Publishing House Pvt. Ltd., New Delhi, 2013.
R3- Pandit G.S. & Gupta S.P. "Structural Analysis – A Matrix Approach", Tata McGraw Hill 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6202	DESIGN OF RCC STRUCTURES	3	0	0	3

Course Objective

1. To study the behavior and design of cantilever and counterfort retaining walls.
2. To gain knowledge on design of various components of water tanks by working stress method.
3. To explore the design of flat slabs and RC walls.
4. To illustrate the basic principles of yield line theory for the analysis and design of slab of various cross sections.
5. To gain knowledge on design of various types of bridges as per IRC.

Unit	Description	Instructional Hours
	RETAINING WALLS	
I	Retaining walls - Types - Earth pressure - Effects of surcharge - Stability requirements – Design of cantilever type retaining wall and Counterfort type retaining wall - Detailing of reinforcement.	9
	WATER TANKS	
II	General design requirements – Underground and tank resting on ground - Overhead Circular and rectangular tanks - Analysis and design using Working Stress methods - Detailing of reinforcement - Codal provisions.	9
	FLAT SLABS, RC WALLS AND STAIRCASES	
III	Types of flat slab - Design of Interior and Exterior panels using Direct Design Method - Use of design aids (SP16) - Reinforced concrete walls - Design of staircases (ordinary and doglegged).	9
	YIELDLINE THEORY	
IV	Yield line – Assumptions – Characteristics – Upper Bound and Lower Bound Theories - Yield Line Analysis - Design of slabs.	9
	RCC BRIDGES	
V	Introduction, Classification of bridges - IRC Loadings-Effective width of load dispersion-Design of solid slab Bridge-Box culverts.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1:Analyze and design of different types of retaining walls and will able to apply the theoretical concepts in the real world construction.

CO2: Design and detail the different types of water tanks along with the staging and foundation.

CO3: Design and detail the flat slabs and reinforced concrete walls.

CO4: Design square, rectangular, circular and triangular slabs using Yield line theory.

CO5: Design and detail the different types of bridges.

TEXT BOOKS:

T1-Krishna Raju, N., "Design of RC Structures", CBS Publishers and Distributors, New Delhi,2016.

T2-Punmia B.C, Ashok Kumar Jain, ArunK.Jain, "R.C.C. Design of Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS:

R1-UnnikrishnaPillai, S., DevdasMenon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi , 2009.

R2-Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012

R3-Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012

CODE BOOKS:

C1 -IS 456-2000: Plain and Reinforced Concrete - Code of Practice.

C2-SP 16 - Design Aids for Reinforced Concrete to IS 456:1978.

C3-IS 3370 (Part IV)- 1967: Code Of Practice for Concrete Structures for The Storage of Liquids.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6203	HYDROLOGY	3	0	0	3

Course Objective

1. To study the concept of hydrometeorology.
2. To have an idea about the types, forms and measurement of precipitation.
3. To understand the components of hydrograph and applications of hydrograph.
4. To learn about the ground water hydrology.
5. To gain knowledge on the importance of flood and flood routing.

Unit	Description	Instructional Hours
	INTRODUCTION AND HYDRO METEOROLOGY	
I	Definition - Development of hydrology - hydrologic design - Hydrologic failures - Importance in Engineering - Hydrological budget. Weather and hydrology - General circulation Temperature humidity -Wind systems.	9
	PRECIPITATION	
II	Hydrologic cycle - Types of precipitation - Forms of precipitation - Measurement of Rainfall - Spatial measurement methods - Temporal measurement methods - Frequency analysis of point rainfall - Intensity, duration, frequency relationship - Probable maximum precipitation.	9
	HYDROGRAPH ANALYSIS	
III	Flood Hydrograph -Components of flood hydrograph - Factors affecting shape of Hydrograph - Base flow separation– Unit hydrograph - Advantages – Instantaneous Unit hydrograph - S curve Hydrograph - Synthetic unit hydrograph - Applications.	9
	GROUND WATER HYDROLOGY	
IV	Occurrence of ground water - Types of aquifer – Dupuit's assumptions – Darcy's law - Estimation of aquifer parameters– Pump tests - steady state discharge in Confined and Unconfined Aquifers - Leaky aquifer -well loss - aquifer loss- problems.	9
	FLOODS AND FLOOD ROUTING	
V	Flood frequency studies – Recurrence interval - Gumbel's method- Flood routing - Reservoir flood routing - Muskingum's Channel Routing - Flood control.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Emphasize the importance of hydrometerology.
CO2:Evaluate the precipitation potential and analyse precipitation data.
CO3: Plot and analyse flood hydrographs
CO4:Estimate the yield and losses in aquifers.
CO5:Comprehend the methods of flood routing based on flood frequency studies.

TEXT BOOKS:

T1 - Jayarami Reddy .P, "Hydrology", Tata McGraw Hill, 2008.
T2 -Santosh Kumar Garg, "Hydrology and Water Resources Engineering", Khanna Publications Pvt.Ltd.NewDelhi, 2015.

REFERENCE BOOKS:

R1 - Subramanya ,"Engineering Hydrology", Tata McGraw Hill Co., Graw Hill Co., 2013
R2 – Ghanshyam Das ,"Hydrology and Soil Conservation Engineering", Prentice-Hall of India , 2009.
R3 - Mutreja, K.N. , "Applied Hydrology", Tata McGraw Hill Publishing Company ,1992

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6204	WASTEWATER ENGINEERING	3	0	0	3

Course Objective

1. To understand the systems of sewerage and estimate the quantity of wastewater.
2. To acquire knowledge on hydraulics and design of sewers.
3. To study the characteristics and composition of sewage and understand the principles of primary sewage treatment.
4. To learn the principles, components and working of various biological treatment processes.
5. To explore the methods of sewage disposal and sludge management..

Unit	Description	Instructional Hours
I	**QUANTITY,COLLECTION AND CONVEYANCE** Sources of wastewater generation - systems of sewerage –Estimation of sewage flow - Fluctuations in flow pattern - Estimation of storm runoff - Design flow - Drainage in buildings - Sanitary fixtures / fittings -General layout of house drainage - street connections .	9
II	**DESIGN OF SEWERS** Hydraulics of sewers - Self cleansing velocities - full flow / partial flow conditions - sewer sections and design - sewer appurtenances - materials for sewers - sewer joints - sewer laying and testing – sewer cleaning and maintenance - sewage pumping - types of pumps.	8
III	**QUALITY OF SEWAGE AND PRIMARY TREATMENT** Characteristics and composition of sewage - Effluent standards - Physical and chemicalanalysis - DO, BOD,COD and their Significance - Cycles of decomposition - Objectives and basic principles of sewage treatment - primary treatment -Selection of unit operation and process - screens - Grit chamber - Settling tank - principles of sedimentations - Design of settling tanks.	10
IV	**BIOLOGICAL TREATMENT OF SEWAGE** Basic principles of biological treatment - Trickling filters - Description and principle of operation of trickling filters - recirculation - Activated sludge process - diffuser /Mechanical aeration - Extended aeration process - oxidation ditches - stabilization ponds - aerated lagoons – UASB –SBR – ASBR – Septic tanks and effluent disposal system – Introduction to advanced wastewater treatment.	9
V	**SEWAGE DISPOSAL AND SLUDGE MANAGEMENT** Methods - dilution method – self-purification of streams – Streeter Phelps equation - oxygen sag curve - land disposal – sewage farming. Objectives of sludge treatment - properties and characteristics of sludge - Thickening - sludge digestion - drying beds - conditioning and dewatering - sludge disposal – Digestion and biogas recovery – elutriation.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students will have ability to

CO1: Estimate the quantity of sewage produced and ascertain the type of sewerage system.
CO2:Design the sewers and select the sewer materials.
CO3:Determine the characteristics of sewage and design the unit operations.
CO4: Design the various biological treatment processes.
CO5:Interpret the various options for sewage disposal and sludge management.

TEXT BOOKS:

T1- Garg. S. K., "Environmental Engineering, Vol I &Vol II", Khanna Publishers, New Delhi, 2017.
T2-Punmia, B.C., Ashok K Jain and Arun K Jain, "WasteWater Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 2012.
R2 - Mark J. Hammer, Mark J. Hammer Jr, "Water and Waste Water Technology", Prenticehall of India, 2012.
R3 -Shah.C. S., "Water supply and Sanitation", Galgotia Publishing company, NewDelhi, 1998.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6001	ENVIRONMENTAL ENGINEERING LAB	0	0	4	2

Course Objective

1. Gain an insight on sampling, preservation methods and the significance of characterization of water and wastewater.
2. Learn to analyze and measure the various physical, chemical and biological parameters of water and wastewater.
3. Understand the principles and operational procedures of modern instrumentation methods adopted in water quality testing.

Expt . No.	Description of the Experiment
1.	Sampling, preservation methods and significance of characterization of water and wastewater
2.	Determination of pH and Turbidity in water
3.	Determination of Available Chlorine in Bleaching Powder solution
4.	Determination of Residual Chlorine in water
5.	Determination of Total Suspended, Volatile, Fixed and Settleable solids in wastewater
6.	Coagulation and Precipitation process for treating wastewater
7.	Determination of Biological Oxygen Demand in wastewater
8.	Determination of Chemical Oxygen Demand in wastewater
9.	Determination of Sulphate in wastewater
10.	Determination of Nitrate in wastewater
11.	Determination of Ammonia Nitrogen in wastewater
12.	Determination of Phosphate in wastewater
13.	Determination of Calcium, Potassium and Sodium
14.	Heavy metals determination – Chromium, Lead and Zinc (Demonstration Only)
15.	Bacteriological Analysis (Demonstration Only)

Total Practical Hours 45

Course Outcome

CO1: Collect, store, preserve and characterize water and wastewater samples based on requirements.
CO2: Illustrate the significance of characterization of water, wastewater and BIS water quality and effluent standards.
CO3: Conduct experiments to determine the various physical, chemical and biological characteristics of water and wastewater samples.
CO4: Demonstrate, analyze and measure the required water quality parameters using advanced instrumentation methods.
CO5:Evaluate and recommend the degree of treatment required for water and wastewater.

REFERENCE BOOKS:

R1 –Standard Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 2015.
R2 – Drinking Water Specifications, Bureau of Indian Standards (IS 10500:2012). R3 - .Manual on Sewerage & Sewage Treatment, Second Edition, CPHEEO, 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6002	DESIGN AND DRAWING-I (RCC & STEEL)	0	0	4	2

Course Objective

1. Understand the procedure involved in analysis and design of concrete and steel structures.
2. Get exposure to the various commands and finite element techniques used in modeling and designing of structures using software applications.
3. Incorporate the design results and values in the detailed drawings of reinforcement.

Expt . No.	Description of the Experiment
1.	Design and Drawing of RCC Cantilever and Counter fort Type Retaining Walls with Reinforcement Detailing.
2.	Design ofCircular and Rectangular RCC Water Tanks with Detailed Drawings of Reinforcement.
3.	Design and Drawing of RCC Solid Slab bridge for IRC Loading with Reinforcement Detailing.
4.	Analysis and design of RC beam by STAAD.Pro
5.	Analysis and design of RC portal frame by STAAD.Pro
6.	Analysis and design of Steel Truss using STAAD.Pro.
7.	Analysis and design of single room with pitched roof by STAAD.Pro.
8.	Design of Rectangular Steel Tank.
9.	Design and Drawing of Plate Girder Bridge.
10.	Design and Drawing of Gantry Girder.
11.	Study of finite Element Modeling and stress analysis of beams.
12.	Study of finite Element Modeling and stress analysis of Trusses.

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Acquire hands on experience in designing and proficiently use the software packagesfor concrete and steel structural design.
CO2 :Design and draft RCC retaining walls and solid slab bridge with reinforcement detailing.
CO3 :Design and stress analysis of finite element modeling structures.
CO4 :Design the draft various types of RCC and steel water tanks with reinforcement detailing.
CO5 :Design and draft plate girder bridges and gantry girder with reinforcement detailing.

REFERENCE BOOKS:

R1- Krishnaraju N., "Structural Design & Drawing Reinforced Concrete and steel", Universities Press,2013.
R2- Punmia B C, Ashok Kumar Jain, Arun Kumar Jain., Comprehensive Design of Steel Structures, Laxmi Publication Pvt. Ltd., 2015.

CODE BOOKS:

C1- IS 456 – 2000 – Code of Practice for Plain and Reinforced Concrete Structures.
C2- IS 800 – 2007 – General Construction in Steel.

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PROFESSIONAL ELECTIVE I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5301	ADVANCED SURVEYING TECHNIQUES	3	0	0	3

Course Objective

1. To understand the fundamentals and components of Modern Surveying Equipment.
2. To learn the basics principles of Global Positioning System.
3. To study the various Methods of Photogrammetry.
4. To gain knowledge on Remote Sensing.
5. To enhance the knowledge on Geographical Information System.

Unit	Description	Instructional Hours
I	**MODERN SURVEYING EQUIPMENT** Introduction – Digital levels - features of digital levels - Components of digital levels - Various capabilities with digital levels – Electronic Distance Measuring Instrument - Electronic Theodolite.	9
II	**GLOBAL POSITIONING SYSTEM** History of navigation system - Radio Navigation Systems - Historical development in satellite positioning - GPS design objectives - Background of GPS evolution - Advantages and current Limitations of GPS - GPS Errors and Accuracy.	9
III	**PHOTOGRAMMETRY** Introduction – Definition - Applications of photogrammetry - Categories of photogrammetry - Information recorded on photographs - Types of projections - Ground co-ordinates for vertical photographs - Flying height for vertical photographs - Numerical problems.	9
IV	**REMOTE SENSING** Definitions - Remote sensing system - Properties used in RS for discrimination - Comparison of RS with other techniques - Physical basis of remote sensing - Nature and properties of EMR - EMR interaction in Atmosphere - Information extraction - Types of pattern recognition - Feature selection / dimensionality reduction.	9
V	**GEOGRAPHICAL INFORMATION SYSTEM** Introduction - Toolbox-based definitions - Benefits of GIS - Components of GIS - GIS manipulation, analysis and modelling functions - Capabilities of raster GIS - Retrieval, classification/reclassification and measurement operations - Overlay operation.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1 – Apply the principles of modern surveying equipment.
CO2 – Summarize the advantages and limitations of GPS
CO3 – Categorize photogrammetry and interpret the vertical photographs
CO4 – Compare and contrast Remote Sensing with other techniques
CO5 –Comprehend GIS manipulation, analysis and modeling functions

TEXT BOOKS:

T1 - Lillesand,T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition., John Willey and Sons Asia Pvt. Ltd., New Delhi, 2007.
T2 - Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2012.

REFERENCE BOOKS:

R1 - Lo.C.P.and A.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems",Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
R2 - Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press, 2015.
R3 - Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2012

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5302	REMOTE SENSING AND GIS	3	0	0	3

Course Objective

1. To learn the basic concepts of remote sensing.
2. To get an idea on geometric elements of a vertical photograph.
3. To acquire knowledge on the concept of image interpretation.
4. To study the elements of GIS.
5. To understand the concept of map overlays and applications of GIS in civil engineering.

Unit	Description	Instructional Hours
	INTRODUCTION TO REMOTE SENSING	
I	Energy Sources and Radiation principles - electromagnetic radiation - characteristic of real remote sensing system, platforms, sensors, satellite, Indian Remote Sensing satellite.	9
	PHOTOGRAMMETRY	
II	Geometric elements of a vertical photograph - Ortho photos, Flight planning - Stereoscopic plotting instruments.	9
	IMAGE INTERPRETATION	
III	Elements of image interpretation, concepts of digital image processing image Rectification and Restoration, Image enhancement, Image classification. Application of Remote sensing in Civil Engineering.	9
	INTRODUCTION TO GIS	
IV	Introduction to GIS - history of development of GIS - elements of GIS, Computer hardware - Software. Data Input, Verification, data storage and database management and output.	9
	GIS ANALYSIS AND APPLICATIONS	
V	Map Overlay - Vector and raster data model, mapping concept, development of map overlay, overlay operation Errors and quality control – Current issues and Trends in GIS application in Civil Engineering.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Appraise the characteristics and principles of remote sensing.
CO2: Implement the elements of photogrammetry.
CO3: Apply the concept of image interpretation.
CO4: Comprehend the development and elements of GIS.
CO5: Develop map overlays, determine operation errors and exercise quality control.

TEXT BOOKS:

T1 - Bhatta. B ,"Remote Sensing and GIS, Oxford University Press", 2008.
T2 -Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2012.

REFERENCE BOOKS:

R1 - Lillesand, T.M. & Kiefer R.W. ,"Remote Sensing and image interpretation", John Wiley & Sons (Asia), Newyork, 2007.
R2 - Burrough P.A. ,"Principle of Geographical Information Systems for land resources assessment", Clarendon Press, Oxford University Press , 2004.
R3 -Clarke Parks & Crane (2005), Geographic Information Systems & Environmental Modelling, Prentice-HallOf India, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5303	BRIDGE ENGINEERING	3	0	0	3

Course Objective

1. To learn the fundamentals of bridge design.
2. To learn the design methodologies of superstructure of bridges.
3. To study about substructure of bridges.
4. To gain knowledge on bearings used in bridges.
5. To understand the failure mechanisms and maintenance of bridges.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BRIDGE ENGINEERING** Historical background of bridges and types. Bridge aesthetics and proportioning. Design process. Review of applicable design codes. Loads on bridges and force distribution. Bridge geometry. Conceptual design. Classification of Bridges. Bridge Hydrology: determination of design discharge, linear water way, economical span, location of piers and abutments, afflux, scour depth.	9
II	**SUPERSTRUCTURE OF BRIDGES** Pigeaud's method for computation of slab moments; courbon's method for computation of moments in girders; Design of simply supported T-beam bridge.	9
III	**SUBSTRUCTURE FOR BRIDGES** Piers - Abutments - Wing walls – Setting out for Piers and Abutments - Materials for substructures – Bridge Inspection – Caissons – Cofferdams – Spread and Pile foundation.	9
IV	**BEARINGS** Purposes of Bearings – Importance of Bearings – Free and Fixed Bearings – Types of Bearings – Bed Blocks - Maintenance of Bearings.	9
V	**BRIDGE MAINTENANCE** Bridge failures – case studies – Maintenance of bridges – Detailed Inspection – Routine Inspection – Posting of Bridges – Rating of Existing bridges – Rebuilding Bridges – Retrofitting and Rehabilitation of bridges.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Classify the bridges and develop a conceptual design with appropriate geometry and size of elements for a bridge.
CO2:Designthe Superstructure of bridges.
CO3:Be proficient in Substructure of bridges.
CO4:Evaluate the types of bearings used in bridges.
CO5: Analyze case studies on bridges and formulate the inspection procedure for bridge maintenance.

TEXT BOOKS:

T1-Ponnuswamy.S "Bridge Engineering", Tata McGraw-Hill, 2017.
T2-KrishnaRaju.N " Design of Bridges", Oxford and IBH , 2008.

REFERENCE BOOKS:

R1-Bakht.B and Jaegar.L.G., "Bridge Analysis Simplified", McGraw Hill, 1992.
R2-Johnson Victor.D, "Essentials of Bridge Engineering", Oxford & IBH, 2007.
R3-KrishnaRaju. N "Structural Design and Drawing: Reinforced Concrete and Steel" , University Press (India) Pvt Limited , 2004

CODE BOOKS:

C1- IRC: 6 - 2014 Standard Specifications and Code of Practice for Road Bridges, Section II - Loads and Stresses (Fifth Revision).
C2- IRC: 21 - 2000 Standard Specifications and Code of Practice for Road Bridges, Section III - Cement Concrete (Plain and Reinforced) (Third Revision).
C3- IRC: 22 - 2008 Standard Specifications and Code of Practice for Road Bridges, Section VI - Composite Construction (Limit States Design) (Second Revision).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5304	CONSTRUCTION PLANNING ANDSCHEDULING	3	0	0	3

Course Objective

1.Study the basic concepts of planning in the diverse construction projects.
2.Learnthe appropriate techniques used for scheduling the resources.
3.Gain knowledge on various costs, control methods and departmental procedure for accounting.
4.Study the quality control and monitoring techniques and the necessity of training to personnel.
5.Understandabout management information system and usage of data base in the project accountings.

Unit	Description	Instructional Hours
I	**CONSTRUCTION PLANNING** Necessity - basic concepts - steps involved in planning - Phases and stages of project plan - Types of construction plans and construction projects - planning for materials, labour and equipment - defining work tasks - precedence relationships among activities - Estimating activity durations - estimating resource requirements for work activities - Program for progress of work and control - bar chart - milestone chart - uses and drawbacks - Terminology - Coding systems.	9
II	**MANAGEMENT TECHNIQUES** Evolution of networks - inter-relationship of events and activities - Fundamental rules for network construction - Critical path method - Program Evaluation and Review Technique - probability of project completion time - precedence networks - Scheduling for activity-on- node networks - resource oriented scheduling - scheduling with resource constraints - improving scheduling process - time-cost relationships - crashing and time / cost trade- offs - introduction to application software(MS Project & Primavera)	9
III	**COST CONTROL, FINANCING AND DEPARTMENAL ACCOUNTING PROCEDURE** Costs and estimates associated with construction - means of financing - financial assistance - project budget - cost control system and codes - financial control and financial accounting systems - project cash flows - Time value of money - capital investment decision - organization of PWD - duties and responsibilities - accounting procedure – administrative and technical sanction - payment of bills - temporary advance account - cash book - work register -M-book - accounting for consumables - record for tools and plants - Work charged establishment – Nominal Muster Roll - Daily Labour Reports.	9
IV	**QUALITY CONTROL, MONITORING AND TRAINING** Importance and elements of quality - organization for quality control - Total quality control - quality control circles - material specifications - quality assurance techniques - quality control by statistical methods -statistical quality control with sampling by attributes and variables - Methods of training - on job and in-plant training - Performance appraisal - documentation.	9
V	**MANAGEMENT INFORMATION SYSTEM** Types of project information - accuracy and use of information - Computerized organization - Management Information System - organizing information in database - Relational model of data base - other conceptual models of database - Centralized database management systems - database and application programs - Information transfer and flow.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Develop construction plans and estimate the resource requirements.
CO2: Choose suitable scheduling technique for the particular project.
CO3: Determine the modern cost account systems and control techniques adopted in the construction projects.
CO4: Make use of advanced management tools for quality control and monitoring techniques towards speedy and guaranteed projects.
CO5: Adopt MIS techniques and data base for complex large projects.

TEXT BOOKS:

T1 -Chitkara, K.K., "Construction Project Management - Planning, Scheduling and Controlling", McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2015.
T2 - Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pitsburgh, 2000.

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REFERENCE BOOKS:

R1 -Willis, E.M., "Scheduling Construction projects", John Wiley and Sons,1986.

R2 - Halpin,D.W., "Financial and cost concepts for construction Management",John Wiley and Sons, New York, 1985.

R3 - Moder.J., C.Phillips and Davis, "Project Management with CPM, PERT and Precedence Diagramming", Van Nostrand Reinhold Co., Third Edition, 1983.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5305	AIRPORTS, DOCKS AND HARBOUR ENGINEERING	3	0	0	3

Course Objective

1. To introduce various components of aircraft and stipulation of airport site selection.
2. To understand the concept of layout and location of airport buildings.
3. To get exposed to the principles in design of runway and taxiway.
4. To familiarize the technical terms of docks & harbour and also get an idea of its design principles.
5. To acquire knowledge of various coastal structures and coastal regulations.

Unit	Description	Instructional Hours
	INTRODUCTION TO AIRPORT PLANNING	
I	Air transport characteristics – Advantages and limitations of air transportation – Aircraft component parts and important technical terms – Selection of sites, engineering survey – Socio-economic characteristics of catchment area – ICAO stipulations.	9
	AIRPORT LAYOUT	
II	Typical airport layouts – Characteristics of good layout – Location of terminal buildings – Aprons and Hangers – Airport Zones – Zoning Requirements – Height of construction and landing within the airport boundary.	8
	AIRPORT DESIGN	
III	Runway Design: Orientation, Wind Rose Diagram – Runway Length – Basic and Actual Length Problems – Geometric Design of Runways, Design of runways – Configuration and Pavement Design Principles – Elements of Taxiway Design – Runway and Taxiway Markings and Lighting.	10
	DOCKS AND HARBOUR	
IV	History of water transportation – modern trends in water transportation – Basic Terms – Harbour, Port, Satellite Port, Docks, Waves, Tides – Components of harbour – Classification of harbours – Site Selection and planning of harbours – Location and Design Principles – Harbour Layout and Terminal Facilities.	9
	COASTAL STRUCTURES	
V	Coastal Structures: Piers, Break Waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins, Floating Landing Stage – Navigational Aid – Inland Water Transport – Wave Action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Understand the components of aircraft and airport characteristics.
CO2. Prepare the layout with proper location of terminal building, aprons and hangers.
CO3. Design the runway and taxiway, its markings and lighting.
CO4. Classify harbours and propose a proper layout based on site conditions.
CO5. Comprehend the various coastal structures and costal protection regulations.

TEXT BOOKS:

T1- Khanna S. K., Arora M. G. and Jain S. S., "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
T2- Bindra S. P., "A Course in Docks and Harbour Engineering:, Dhanpat Rai and Sons, New Delhi, 2013.

REFERENCE BOOKS:

R1- Rangwala, "Aiport Engineering", Charotar Publishing House, 2013.
R2- Rangwala, "Harbour Engineering", Charotar Publishing House, 2013.

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PROFESSIONAL ELECTIVE II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6301	ARCHITECTURE	3	0	0	3

Course Objective

1. Classify and explore the elements and principles of design in architecture.
2. Understand the importance of site analysis, layout regulations and layout design concepts.
3. Explore the concepts of anthropometry, safety standards and integration of basic building services.
4. Learn the impact of climate in the architectural design and green building concepts.
5. Study the basic principles of town planning, zoning regulations, and landscape design.

Unit	Description	Instructional Hours
	ARCHITECTURAL DESIGN	
I	Architectural design – An analysis – Integration of function and aesthetics – Introduction to basic elements and principles of design – Ancient, medieval and modern styles of architecture.	9
	SITE PLANNING AND LAYOUT DESIGN	
II	Surveys – Site analysis – Development Control – Layout regulations- Layout design concepts.	8
	ANTHROPOMETRY AND SPACE STANDARDS	
III	Residential, institutional, commercial and Industrial – Application of anthropometry and space standards - Inter relationships of functions – Safety standards – Building rules and regulations – Integration of building services – Interior design.	12
	CLIMATE AND ENVIRONMENTAL RESPONSIVE DESIGN	
IV	Man and environment interaction- Factors that determine climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls – Green building concept.	8
	TOWN PLANNING AND LANDSCAPING	
V	Planning – Definition, concepts and processes- Urban planning standards and zoning regulations- Urban renewal – Conservation – Principles of Landscape design.	8
	Total Instructional Hours	**45**

Case Study 1: South Indian Architecture – Concepts and Execution.
Case Study 2: Smart City Concept Plan for Coimbatore.

Course Outcome

Upon successful completion of the course, students will have the ability to

1. Incorporate the basic elements and principles of architecture in the design of a building.
2. Perform site analysis and apply the layout design concepts while designing a building.
3. Apply the principles of anthropometry, safety standards and integrate the basic building services in building design.
4. Design a building taking into account the various environmental considerations and green building concepts.
5. Consider the principles of town planning; zoning regulations and landscaping while planning

TEXT BOOKS:

T1 - Francis D.K. Ching, "Architecture: Form, Space and Order", VNR, N.Y., 2014.
T2 - Muthu Shoba Mohan, "Principles of Architecture" Oxford University Press, New Delhi, 2010.

REFERENCE BOOKS:

R1 - Edward D. Mills, "Planning The Architects Handbook", Butterworth London, 1985.
R2 - Givoni B., "Man , Climate and Architecture", Van Nostrand Reinhold ,1981
R3.-Margaret Robert, "An Introduction to Town Planning Techniques", Hutchinson London, 1991.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6302	INTERIOR DESIGN	3	0	0	3

Course Objective

1. Learn the basic principles and processes of interior design.
2. Explore the historical development of interior design through the ages.
3. Compare and contrast the various elements, methods and materials involved in interior design.
4. Get conversant with the principles, types and effects of lighting and interior landscaping.
5. Understand the significance of anthropometry and space standards in furniture design and space planning.

Unit	Description	Instructional Hours
	INTRODUCTION TO INTERIOR DESIGN	
I	Definition of interior design - Interior design process - Vocabulary of design in terms of principles andelements - Introduction to the design of interior spaces as related to typologies and functions, themes andconcepts - Study and design.	8
	HISTORY OF INTERIOR DESIGN	
II	Brief study of the history of interior design through the ages relating to historical context, design movementsand ideas etc. - Brief study of folk arts and crafts - Vernacular design in Indiawith reference to interior designand decoration.	8
	ENCLOSING ELEMENTS	
III	Introduction to various elements of interiors like floors. ceilings, walls, staircases, openings, interior service elements, incidental elements etc. and various methods of their treatment involving use of materials andmethods of construction in order to obtain certain specific functional, aesthetic and psychological effects.	9
	LIGHTING ACCESSORIES AND INTERIOR LANDSCAPING	
IV	Study of interior lighting - Different types of lighting their effects types of lighting fixtures. Other elements ofinteriors like accessories used for enhancement of interiors – Paintings, objects de art, etc. Interior landscaping -Elements like rocks, plants, water, flowers, fountains, paving, artifacts, etc. their physical properties, effects onspaces and design values.	10
	FURNITURE DESIGN AND SPACE PLANNING	
V	Study of the relationship between furniture and spaces - human movements & furniture design as related tohuman comfort. Function, materials and methods of construction - changing trends and lifestyles – innovationsand design ideas - Study on furniture for specific types of interiors like office furniture, children's furniture,residential furniture, display systems, etc. – Design Projects on Residential, Commercial and Office Interiors.	10
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have the ability to

CO1: Employ the basic principles and processes while designing the interior of a building.

CO2: Design the interiors based on local needs, availability of construction materials and reflecting local traditions.

CO3: Combine the right elements, materials and methods in order to obtain certain specific functional, aesthetic and psychological effects.

CO4: Choose and propose suitable methods of lighting and interior landscaping based on the requirements.

CO5: Consider the relationship between furniture and spaces while planning interiors for human comfort.

TEXT BOOKS:

T1 - Francis .D.K. Ching, "Interior Design Illustrated", John Wiley & Sons, NY, 2018.

T2 - Julius Penero and Martin Zelnik, "Human Dimensions and Interior space Whitney Library of Design", NY1979.

REFERENCE BOOKS:

R1 - Steport - De Van Kness, Logan and Szebely, "Introduction to Interior Design", Macmillan Publishing Co.,NY 1980.

R2 - Inca / Interior Design Register, Inca Publications, Chennai, 1989.

R3 - SyanneSlesin and Stafford Ceiff - Indian Style, Clarkson N. Potter, Newyork, 1990.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6303	URBAN PLANNING AND DEVELOPMENT	3	0	0	3

Course Objective

1. To know the theories, concepts and models of planning.
2. To study the various elements of infrastructure and their planning.
3. To discuss about standards and guidelines for metropolitan and regional planning.
4. To gain knowledge on site selection for housing andvarious housing design typologies.
5. To understand the processes involved in housing project development.

Unit	Description	Instructional Hours
	INTRODUCTION TO PLANNING ANALYSIS	
I	Origins & growth of cities – Basic elements of the city – Town planning in ancient India; Medieval, renaissance, industrial &postindustrial cities – Theories – Concepts – Planning models & Approaches – Orthodoxies of planning – Contribution of housing to micro & macro economy – Contribution to National wealth & GDP – Housing taxation, National budgets, forward & backward linkages.	9
	INFRASTRUCTURE PLANNING	
II	Elements of infrastructure (Physical, Social, Utilities & Services) – Water supply planning – Resource analysis - quality of water system design – Technological choices of alternatives – Water demand (context, need assessment & planning requirements) – Rate of demand – Conveyance & distribution system (methods of distribution & maintenance) – Biological concepts in environmental sanitation – Solid waste disposal & management – Fire fighting – Critical issues in infrastructure planning.	9
	METROPOLITAN & REGIONAL PLANNING	
III	Growth of cities & system of cities, its impact on National development, resources in cities – Metro & Mega cities: Problems & Issues - Growth Trends – Approach to development – Definition, scope & content of Regional planning – Methods & purpose of Regionalisation – Concept of regional growth process – Spatial growth process.	9
	SITE PLANNING AND HOUSING DESIGN	
IV	Site Planning : Selection of site for housing, consideration of physical characteristics of site, locationalfactors,orientation,climate,topography–Landscaping-Housingdesign-Traditional housing, row housing, cluster housing –apartments and high rise housing relating to Indian situations –case studies in India –integration of all types of services, parking, incorporation of green sustainable practices –prefabrication in housing.	9
	HOUSING PROCESS	
V	Various stages and tasks in project development –community participation and housing management –Environmental aspects - national calamities and disaster mitigation.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Understand issues relating to Housing policy and its impact on housing development.

CO2:Implement the various elements in infrastructure planning.

CO3:Review the growth and trends of metro cities and plan according to the spatial growth Process.

CO4: Evaluate the site for housing and also integrate the various services in house planning and designing.

CO5: Organize the various stages and tasks in housing process.

TEXT BOOKS:

T1- Richard Kintermann and Robertsmall, "Site planning for Cluster Housing", Van Nastrand Reinhold company, Jondon / NewYork 2003.

T2–JosephdeChiaraandothers, "Time Saver Standards for Housing and Residential development", McGraw Hill Co, NewYork 2009.

REFERENCE BOOKS:

R1 – Christopher Alexander,"A Pattern Language", Oxford University press, NewYork 1977.

R2–Saxena A. K,, "Sociological Dimensions of Urban Housing and Development", Common wealth Publications, 2004.

R3- Geol. S. L. Dhaliwal. S. S. "Slum improvement through participatory Urban based Community structures", Deep & Deep Publications, 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6304	HOUSING PLANNING AND MANAGEMENT	3	0	0	3

Course Objective

1. To provide students an exposure on basic housing related terms.
2. To acquire knowledge on housing programs.
3. To gain knowledge on planning and design of housing projects.
4. To get exposed to cost effective techniques and materials.
5. To get familiarized with housing finance and project appraisal.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO HOUSING** Introduction to Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing – DC regulations - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.	9
II	**HOUSING PROGRAMMES** Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Role of Public housing agencies, and Private sector in supply – Role of Non-Government Organizations in slum housing.	9
III	**PLANNING AND DESIGN OF HOUSING PROJECTS** Formulation of Housing Projects – Land Use and Soil suitability analysis -Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) – Housing Project Formulation.	9
IV	**CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS** New Constructions Techniques – Cost Effective Modern Materials and methods of Construction-Green building concept- Building Centers – Concept, Functions and Performance Evaluation.	9
V	**HOUSING FINANCE AND PROJECT APPRAISAL** Appraisal of housing projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy- Public Private Partnership Projects – Pricing of Housing Units (Problems).	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Incorporate the technical terms in relation with housing policy and project.
CO2. Comprehend and understand the specifications and plan of various housing programmes.
CO3. Handle the planning and design of various housing projects.
CO4. Use the cost effective techniques and materials to reduce the project cost.
CO5. Perform financial appraisal of housing projects.

TEXT BOOKS:

T1- Meera Mehta and Dinesh Mehta, "Metropolitan Housing Markets", Sage Publications Pvt. Ltd., New Delhi, 2007.
T2- Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House,Bombay, 2010.

REFERENCE BOOKS:

R1- Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design", 8th Edition,Tata McGraw Hill Edition, 2011.
R2- Dhanalakshmi G , Anbarasan . S, " Housing Planning And Management", KKS Publishers, 2012. R3- **Chandra Sekar K. ,.Karthikeyan .N., " Housing Planning & Management", CGS Publications, 2011.**

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6305	ENGINEERING ECONOMICS AND COST ANALYSIS	3	0	0	3

Course Objective

1. Get conversant with the basic laws of economics, its components, nature and scope.
2. Understand the importance of demand, supply and its role in the market structure.
3. Explore the various forms of organization, economic systems and banking systems.
4. Classify the various types of financing and learn how to prepare balance sheets and funds flow statements.
5. Compare and contrast the various types of costs, prices and feasibilities of a project.

Unit	Description	Instructional Hours
I	**BASIC ECONOMICS** Definition of economics – nature and scope of economic science – nature and scope of economics – basic terms and concepts – goods – utility – value – wealth – factors of production – land – its peculiarities – labour – economies of large and small scale – consumption – wants – its characteristics and classification – law of diminishing marginal utility – relation between economic and technical decision.	8
II	**DEMAND AND SCHEDULE** Demand – demand schedule – demand curve – law of demand – elasticity of demand – types of elasticity – factors determining elasticity – measurement – its significance – supply – supply schedule – supply curve – law of supply – elasticity of supply – time element determination of value – market price and normal price – perfect competition – monopoly – monopolistic competition.	8
III	**ORGANISATION** Forms of business – proprietorship – partnership – joint stock company – cooperative organization – state enterprise – mixed economy – money and banking – banking – kinds – commercial banks – central banking functions – control of credit – monetary policy – credit instrument.	8
IV	**FINANCING** Types of financing – short term borrowing – long term borrowing – internal generation of funds – external commercial borrowings – assistance from government budgeting support and international finance corporations – analysis of financial statement – balance sheet – profit and loss account – funds flow statement.	8
V	**COST AND BREAKEVEN ANALYSIS** Types of costing – traditional costing approach – activity based costing – fixed cost – variable cost – marginal cost – cost output relationship in short and long run – pricing practice – full cost pricing – marginal pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project – profitability – internal rate of return – payback period – net present value – cost benefit analysis – feasibility reports – appraisal process – technical feasibility - economic feasibility - financial feasibility – break even analysis – managerial uses of breakeven analysis.	13
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students will have the ability to

CO1: Employ the laws of economics when making technical and economic decisions in a business organization.

CO2: Interpret the significance of supply, demand and its role in a competitive market structure.

CO3: Correlate the various forms of organizations and select a suitable one on based on the current economic situation.

CO4: Prepare balance sheets and funds flow statements of a given business organization.

CO5: Assess the feasibility of a project and schematize a break even analysis for a given project.

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TEXT BOOKS:

T1. Dewett K. K. & Varma J. D., "Elementary Economic Theory", Sultan Chand &Sons, 2006.

T2. William Boyes &Michael Melvin "Principles of Economics", 9th Edition, South-Western College Publishing, 2012.

REFERENCE BOOKS:

R1. Paul Samuelson & William Nordhaus., "Economics - An Introductory Analysis", 19th Edition, McGraw-Hill, 2010.

R2. Varshney R. L. and Maheshwary K. L. "Managerial Economics" 22nd Edition, Sultan Chand & Sons, 2014.

R3. Dwivedi D. N. "Managerial Economics", 7th Edition, Vikas

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OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6401	BUILDING SERVICES	3	0	0	3

Course Objective

1. Impart knowledge on the various electrical systems and components in building construction.
2. Make the students conversant with the principles of illumination and lighting design.
3. Educate the students on the various methods of ventilation systems and air-conditioning facilities.
4. Emphasize the importance of fire safety in buildings.
5. Provide the basic knowledge on plumbing and drainage systems in buildings.

Unit	Description	Instructional Hours
	ELECTRICAL SYSTEMS IN BUILDINGS	
I	Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planningelectrical wiring for building – Main and Distribution boards – Transformers and switch gears - Layout ofsubstations.	9
	PRINCIPLES OF ILLUMINATION AND DESIGN	
II	Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering – Design of modern lighting – Lighting for stores and house lighting - Lighting for offices, schools, hospitals.	8
	VENTILATION AND AIR CONDITIONING	
III	Ventilation – Requirements – Natural and mechanical systems – Ventilation rate measurements - Thermodynamics – Terms and definitions - Refrigerants – Vapour compression cycle – Compressors – Evaporators – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire.	10
	FIRE SAFETY INSTALLATIONS	
IV	Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems - Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers - Fire alarm system, snorkel ladder.	9
	PLUMBING AND DRAINAGE	
V	Plumbing fixtures and fittings – Water conserving fittings – Over flows – Strainers and connectors – Prohibited fixtures – Special fixtures – Installation of water closets – Urinals – Flushing devices – Floor drains – Shower stalls – Bath tubs – Bidets – Minimum plumbing facilities – Rainwater harvesting systems – Necessity – Construction and types.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Illustrate and design the electrical supply systems, systems of wiring and protective electrical installationsincluded in buildings.
CO2: Incorporate the concepts of illumination and its principles while designing the lighting system of a building.CO3: Integrate the principles of ventilation and air conditioning in the design of buildings
CO4: Evaluate and select the proper fire safety systems and devices on the basis of the chosen selection criteria. CO5: Understand the importance of plumbing, drainage and rain water harvesting systems involved in buildings.

TEXT BOOKS:

T1 -David V. Chadderton, "Building Services Engineering", Taylor & Francis, New York, 2007.T2 -G. Steffy, Architectural Lighting Design, John Wiley and Sons, 2008.

REFERENCE BOOKS:

R1 -National Building Code of India, NBC, 2005.
R2 - Uniform Plumbing Code of India, IAPMO, 2015.
R3 -C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 1988.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7201	ESTIMATION, COSTING ANDVALUATIONENGINEERING	3	0	0	3

Course Objective

1. To familiarize the methods of estimates.
2. To understand the schedule of rates for rate analysis.
3. To get exposed to various detailed and general specifications to meet out legal requirements.
4. To emphasize the importance of proper valuation of buildings.
5. To study the principles of report preparation.

Unit	Description	Instructional Hours
	ESTIMATION OF BUILDINGS AND OTHER STRUCTURES	
I	Introduction to estimation – Purpose of estimates – Types of estimates – Units of measurement – Methods of estimates – Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, White washing and Painting/ Varnishing for buildings with flat and pitched roof – Types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for paneled and glazed doors, windows, ventilators, handrails etc., - Estimates of septic tank, soak pit, sanitary and water supply installations and pipe lines – tube and open well – Estimates of bituminous and cement concrete roads – Estimates of culverts.	11
	RATE ANALYSIS	
II	Analysis of rates – Factors affecting the cost of materials and labour – Taking out quantity – Measurement and abstract sheets – Task work – Schedule as basis of costs – Plant and equipment costs – Hour costs based on total costs and output – Transport – Overhead charges – Standard schedule of rates.	8
	SPECIFICATION AND TENDERS	
III	Data – Specification – Sources – Detailed and general specification – Arbitration and legal requirements – Tenders – e-Tender – Tender notice and document – Contracts – Types of contracts – Drafting of contract documents.	8
	FUNDAMENTALS AND METHODS OF VALUATION	
IV	Principles and purpose of valuation – Types of values – Book value, Salvage Value, Scrap value, Replacement value, Reproduction value, Earning value, Market value, Distress value, Capitalized value – Depreciation – Methods of calculation depreciation – Straight line method, Declining balance method, sinking fund method, Quantity survey method – Valuer and his duties – Mortgage – Lease – Methods of valuation – Rental method, Belting method, Valuation based on land and building – Valuation from yield.	10
	REPORT PREPARATION	
V	Principles for report preparation – Report on estimate of building, Culverts, Roads, Water and sanitary installations, Tube and open wells, Retaining walls, Aqueducts.	8
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Produce a detailed estimated report considering the building plan and additional amenities.
CO2: To do rate analysis based on the knowledge gained from schedule of rates
CO3 :Specify the importance of detailed and general specifications.
CO4: Calculate depreciation and estimate the value of the building.
CO5: Prepare a detailed report with accurate specification and values.

TEXT BOOKS:

T1- Dutta B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd.,2016
T2- Kohli D.D and Kohli R.C., "A Text Book of Estimating and Costing (Civil)", S Chand & Company Ltd.,2013

REFERENCE BOOKS:

R1- PWD Data Book.
R2- Tamilnadu Transparencies in Tender Act, 1998
R3- Standard Bid Evaluation Form, Procurement of Goods or Works, 1996.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7202	CONCRETE TECHNOLOGY	3	0	0	3

Course Objective

1. To get exposed to various ingredients and admixtures used in concrete.
2. To be conversant with the principles of mix design as per codal provisions.
3. To know about the properties of fresh and hardened concrete.
4. To understand special concretes and their uses.
5. To study the various concreting techniques.

Unit	Description	Instructional Hours
	CONCRETE INGREDIENTS AND ADMIXTURES	
I	Introduction – Cement – Types, Chemical composition, Properties – Tests on cement – Aggregate – Classification (Fine and Coarse), Properties – Tests as per BIS grading requirements – Water – Quality of water for use in concrete – Admixtures – Types – Chemical Admixtures – Accelerators, Retarders, Plasticizers, Super Plasticizers, Water Proofers – Mineral Admixtures – Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag, Metakaoline – Their effects on Concrete.	9
	MIX DESIGN	
II	Principles of Mix Design – Concrete grade – Strength requirement and physical properties of materials required – Nominal and Design Mix – BIS (IS 10262 – 2009) and ACI Method of Mix Design – Examples on Mix Design.	9
	PROPERTIES OF CONCRETE	
III	Fresh Concrete Properties – Workability, Segregation and Bleeding – Tests on Fresh Concrete – Hardened Concrete Properties – Elastic properties, Creep and Shrinkage, Strength – Tests on hardened Concrete – Stress – Strain Curve – Young's Modulus – Non – Destructive Tests on Concrete – Durability Tests – Permeability, Carbonation, Water Absorption, Sorptivity.	9
	SPECIAL CONCRETE	
IV	Types of Special Concrete – Properties – Application – Materials Used – Light Weight Concrete (LWC) – High Strength Concrete (HSC) – Cellular Light Weight Concrete (CLC) – High Performance Concrete (HPC) – Fiber Reinforced Concrete (FRC) – Polymer Concrete – Geopolymer Concrete (GPC) – Self Compacting Concrete (SCC) – Ferro cement – Shotcrete – Ready Mix Concrete (RMC).	10
	CONCRETING TECHNIQUES	
V	Process and Manufacturing of Concrete – Mixing and Batching Methods – Methods of Transportation – Placing and Compacting – Curing – Finishing – Cold and Hot Weather Concrete (Extreme Weather) – Pre-packed Concrete.	8
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Identify the detailed significance of each ingredient in concrete.
CO2. Design the concrete mix as per codal provisions.
CO3. Determine the properties of fresh and hardened concrete.
CO4. Categorize and suggest special concretes for various applications.
CO5. Propose proper mixing and placing techniques for concrete.

TEXT BOOKS:

T1- Varghese.P.C., "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015
T2- Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd., 2008.
T3- Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Ltd., New Delhi.2017.

REFERENCE BOOKS:

R1- Santhakumar A R., "Concrete Technology", Oxford University Press, New Delhi.2006
R2- Duggal S K., "Building Materials ", 4th Edition, New Age International.2009

CODE BOOKS:

C1-IS 10262 (2009): Guidelines for concrete mix design proportioning.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7203	IRRIGATION AND HYDRAULIC STRUCTURES	3	0	0	3

Course Objective

1. To learn the methods of irrigation and understand the factors influencing their efficiencies.
2. To study the components and types of diversion headworks.
3. To gain knowledge on the design procedure for a gravity dam.
4. To learn the various types of dams, their components and failure mechanisms.
5. To gain insight into canal regulation works and design its components.

Unit	Description	Instructional Hours
	IRRIGATION PRACTICE	
I	Necessity – Advantages and types of irrigation – methods of irrigation – Soil- water- plant relations - main crops and their seasons – saline, alkaline soils and their reclamation – root zone depth – Duty and Delta – relationship – Factors affecting duty – optimum utilization of water – Consumptive use of water by a crop – Estimation - assessment of irrigation water – Irrigation efficiencies – Problems.	9
	DIVERSION HEADWORKS	
II	Functions of diversion headworks – Types – Layout of diversion headworks – Component parts – functions - Weir – types – Causes of failure of weirs and their remedies – Design of impervious floor – Creep theories – Bligh's theory - Khosla's theory – Design of a vertical drop weir – Design principles for under sluices.	9
	GRAVITY DAM	
III	Forces acting and their computation – Modes of failures - Elementary profile of a gravity dam – High and Low gravity dams – Practical profile – Stresses acting on dam - Design procedure for a gravity dam.	9
	ARCH, BUTTRESS AND EARTH DAMS	
IV	Types of Arch dams – forces acting on it – advantages - design procedure by thin cylinder theory. Buttress dams – types and uses of buttress dams. Earth dam- types of earth dams – Method of construction - elementary section of earth dams – Causes of failure of earth dams - criteria for safe design of earth dams – Cross sections of earth dam according to materials- seepage control in earth dam.	9
	CANAL REGULATION WORKS	
V	Canal falls – types – Design of vertical drop fall – Functions of Regulators - Design of head and cross regulators – Cross drainage works – types of cross drainage works – Selection of suitable types of cross drainage works – Classification of aqueducts and syphon aqueducts – Design features for cross drainage works.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students will have ability to

CO1: Compare the various methods of irrigation and estimate the optimum water requirement.
CO2: Apply the principles and theories for the design of diversion headworks.
CO3: Compute the forces, analyse and design gravity dams.
CO4: Compare and contrast the construction techniques and failure mechanisms of arch, buttress and earth dams.
CO5: Design the various units of canal regulation works.

TEXT BOOKS:

T1 - Santosh Kumar Garg, "Irrigation Engineering and Hydraulics Structures", Khanna Publications Pvt.Ltd.New Delhi, 2017.
T2 -Punmia .B.C. and Pande B.B.Lal, "Irrigation and Water Power Engineering", Laxmi Publications Pvt.Ltd. New Delhi, 2009.

REFERENCE BOOKS:

R1 -Sharma. R.K. and Sharma. T.K "Irrigation Engineering and Hydraulics Structures", S. Chand & company Pvt.Ltd, New Delhi, 2007.
R2 - Michel A.M., "Irrigation Engineering", Vikas Publishing House Pvt.Ltd, New Delhi, 2009.
R3- Asawa, G.L., "Irrigation Engineering", New Age International Publishers, New Delhi, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7001	DESIGN AND DRAWING –II(IRRIGATION &ENVIRONMENTAL ENGINEERING)	0	0	4	2

Course Objective

1. Learn the design procedure of various irrigation and environmental engineering structures.
2. Study the plan, elevation and cross sectional details of irrigation and environmental engineering structures.
3. Acquire hands on experience in designing and preparation of drawings for irrigation and environmental engineering structures.

Expt . No.	Description of the Experiment
	IRRIGATION ENGINEERING
1.	Tank Surplus Weir (Type A)
2.	Tank Sluice with a Tower Head
3.	Canal Drop
4.	Canal Regulators and river regulators.
5.	Cross-Drainage Works (Syphon Aqueduct type II)
	ENVIRONMENTAL ENGINEERING
6.	Intake tower
7.	Sedimentation tank
8.	Clariflocculator
9.	Slow sand filter
10.	Rapid sand filter
11.	Trickling filter
12.	Septic tank with dispersion trench and soak pit

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Understand the principles and function of various components of irrigation and environmental engineering structures.

CO2: Read the drawings and visualize the various components and its dimensions of irrigation and environmental engineering structures.

CO3: Design the various components of irrigation engineering structures.

CO4: Draft the plan, elevation and sectional views of irrigation and environmental engineering structures.

CO5: Incorporate the design results and dimensions while preparing the drawings of irrigation and environmental engineering structures.

TEXT BOOKS:

T1 - Sathya Narayana Murthy Challa , "Water Resources Engineering " Principles and PracticeNewAgeInternational (P) Ltd., New Delhi – 2006.

T2 - Rangwala.S.C, "Fundamentals of water supply and sewerage engineering", Charotar Publishing 2016.

REFERENCE BOOKS:

R1 -Santosh Kumar Garg, Irrigation Engineering and Hydraulics Structures, Khanna Publications Pvt.Ltd, New Delhi, 2017.

R2 - Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi,2014.

R3 - Manual of Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7002	DESIGN PROJECT	0	0	6	3

Course Objective To impart knowledge and improve the design capability of the student.

Description	Total Hours
This course conceives purely a design problem in any one of the disciplines of Civil Engineering. e.g. Design of an RC structure, Design of a wastewater treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course, the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.	60

Course Outcome Upon successful completion of the course, students will have better experience in designing the various structures / components / processes related to Civil Engineering.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8201	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	3	0	0	3

Course Objective

1. To learn the basics of various dynamic forces and the response of structures to it.
2. To study the mode shapes of the structure under dynamic loading
3. To learn the elements of seismology and understand the guidelines for earthquake resistant design.
4. To study the behavior of the structure in response to earthquakes and the importance of ductility in earthquake resistant design.
5. To gain knowledge on the various techniques and codal provisions available for the design of earthquake resistant structures.

Unit	Description	Instructional Hours
	THEORY OF VIBRATIONS	
I	Concept of inertia and damping – Types of damping – Difference between static forces and dynamic excitation –degrees of freedom – SDOF idealization – Equations of motion of SDOF system of mass as well as base excitation –Free vibration of SDOF system – response to harmonic excitation.	9
	MULTIPLE DEGREE OF FREEDOM SYSTEM	
II	Two degree of freedom system – Normal modes of vibration – Natural frequencies – Mode shapes – Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations)	9
	ELEMENTS OF SEISMOLOGY AND SEISMIC DESIGN CONCEPT	
III	Causes of earthquake – Geological faults – tectonic plate theory –Elastic rebound – Epicentre – Hypocentre – primary, shear and Rayleigh waves – seismogram – magnitude and intensity of earthquake – magnitude and intensity scales– Spectral acceleration – Information on some disastrous earthquakes – concept of earthquake resistant design –strong column weak beam concept – guide lines for seismic resistant construction – effects of structural irregularities – seismo resistant building architecture.	9
	RESPONSE OF STRUCTURES TO EARTHQUAKES	
IV	Response and design spectra –Design earthquake – concept of peak acceleration – Site specific response spectrum – Pinching effect – Bauschinger effect – Importance of ductility – Methods of introducing ductility into RC structures.	9
	DESIGN METHODOLOGY	
V	IS 1893, IS 13920 and IS 4326 – Codal provisions – design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquakes on structures.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Understand the theory of vibrations and determine response of structures.
CO2: Evaluate the magnitude and interpret the intensity of earthquake.
CO3: Discuss the elements of seismology and implement the guide lines for the design of seismic resistant construction.
CO4: Include the principles of the response spectra and design spectra in the design of earthquake resistant structure
CO5: Identify and incorporate the various techniquesused to design Earthquake Resistant Structures

TEXT BOOKS:

T1- Chopra, A.K., "Dynamics of structures – Theory and Applications to Earthquake Engineering", Fifth Edition, Pearson Education, 2016.
T2- S.R. Damodarasamy & S.Kavitha, "Basics of structural dynamics and Aseismic Design", PHI Learning Private Ltd., 2009.

REFERENCE BOOKS:

R1- Biggs, J.M., "Introduction to Structural Dynamics", McGraw Hill Book Co., New York, 1964
R2- Pankaj Agarwal and Manish ShriKhande, "Earthquake Resistant Design of Structures", Prentice- Hall Of India, 2007, New Delhi

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R3- Mario Paz and William Leigh "Structural Dynamics – Theory & Computation", Kluwer Academic Publishers, 2012

CODE BOOKS:

C1- IS 1893(Part- I):2002 Criteria for Earthquake Resistant Structures – General provisions and Buildings.
C2- IS 13920:1993 Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.
C3- IS 4326:1993 Earthquake Resistant Design and Construction of Buildings - Code of Practices.

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PROFESSIONAL ELECTIVE III

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7301	AIR POLLUTION MANAGEMENT	3	0	0	3

Course Objective

1. To classify the sources and understand the effects of air pollution.
2. To study the dispersion of pollutants.
3. To know the various techniques and equipment for control of air pollution.
4. To learn about the air quality standards.
5. To gain knowledge on indoor air pollution and noise pollution.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Effects of air pollution on human beings, materials, vegetation, animals – Global warming - Ozone layer depletion, sampling – Basic principles – Source and ambient sampling – Analysis of pollutants.	9
II	**DISPERSION OF POLLUTANTS** Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric Stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.	9
III	**AIR POLLUTION CONTROL** Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – Gaseous pollutants control by adsorption, absorption, condensation, combustion.	9
IV	**AIR QUALITY MANAGEMENT** Air quality standards–Air quality monitoring–Preventive measures - Air pollution control efforts– Zoning –Town planning regulation of new industries –Legislation and enforcement– Environmental Impact Assessment and Air quality.	9
V	**INDOOR AIR QUALITY AND NOISE POLLUTION** Sources, types and control of indoor air pollutants - sick building syndrome types – Sources of noise pollution – Effects – Assessment - Standards – Control methods –Prevention.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Recognize the different sources of air pollution and predict the impacts.
CO2:Interpret the dispersion of pollutants based on meteorological conditions.
CO3:Propose suitable control equipment for various air pollutants.
CO4: Apply the regulatory requirements for air quality monitoring and town planning.
CO5:Categorize the sources and suggest control measures for indoor air pollution and noise pollution.

TEXT BOOKS:

T1-Rao.C.S, "Environmental Pollution Control Engineering", Wiley Eastern Ltd.New Delhi, 2006.T2 - Rao.M.N, and Rao.H. V. N, "Air Pollution Control", Tata-McGraw-Hill, New Delhi, 2007.

REFERENCE BOOKS:

R1 -Lawrence K. Wang, Norman C. Pereira, Yung-Tse Hung, Air Pollution Control Engineering, Humana Press, 2004.
R2 - Heumann.W.L, "Industrial Air Pollution Control Systems", McGraw-Hill, New York, 2007.
R3 -Mahajan.S.P, "Pollution Control in Process Industries", Tata McGraw-Hill Publishing Company, New Delhi, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7302	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3

Course Objective

1. To have an overview on EIA and EIS.
2. To study about the EIA methods.
3. To assess the impacts on the environment.
4. To acquire knowledge on Environmental Management Systems.
5. To gain knowledge on EIA and EIS from case studies

Unit	Description	Instructional Hours
	OVERVIEW	
I	Impact of development on environment - Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS) - Objectives - Historical development - EIA capability and limitations - Legal provisions on EIA.	9
	EIA METHODS	
II	Methods of EIA - Strengths, weaknesses and applicability - Appropriate methodology - Case studies.	9
	PREDICTION AND ASSESSMENT	
III	Assessment of impact on land, water, air, social & cultural activities and on flora & fauna- Mathematical models- Public participation.	9
	ENVIRONMENTAL MANAGEMENT PLAN	
IV	Plan for mitigation of adverse impact on environment - Options for mitigation of impact on water, air, land and on flora & fauna - Addressing the issues related to the Project Affected People. Post project monitoring.	9
	CASE STUDIES	
V	EIA for infrastructure projects - Bridges - Stadium - Highways - Dams - Multi-storey Buildings - Water Supply and Drainage Projects.	9
	Total Instructional Hours	45

Case study 1 :Case Studies of Environmental Impact Assessment Air Quality Issues.Case study 2 :Case Studies on Biodiversity and Impact Assessment.

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Summarize the need for EIA, its development, capabilities and limitations.
CO2:Demonstrate the EIA methods.
CO3: Assess the impacts on the environment.
CO4:Implement Environmental Management Systems in development projects.CO5:Comprehend and prepare EIA report based on case studies.

TEXT BOOKS:

T1 - Anjaneyalu,Y. , "Environmental Impact Assessment Methodologies", B.S. Publications, Hyderabad, 2011.
T2 - Canter R.L. ,"Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1995

REFERENCE BOOKS:

R1 -Environmental Assessment Source book , Vol.I, II & III., The World Bank, Washington, D.C, 2013.
R2 - Judith Petts , Hand book of Environmental Impact Assessment, Vol.I & II, Blackwell Science, 2011.
R3 - Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7303	MUNICIPAL SOLID WASTE MANAGEMENT	3	0	0	3

Course Objective

1. To gain knowledge on the types and characteristics of solid waste and the elements of solid waste management system.
2. To acquire adequate information on various options for on-site storage and processing.
3. To know about the collection and transfer methodologies of solid waste.
4. To study the various off-site processing techniques for solid waste management.
5. To understand the various methods of disposal of solid waste.

Unit	Description	Instructional Hours
I	**SOURCES AND TYPES** Sources and types of solid wastes – Quantity – Factors affecting generation of solid wastes; characteristics–Methods of sampling and characterization –Effects of improper disposal of solid wastes–Public health and environmental effects –Functional elements in a solid waste management system–Social & economic aspects-Public awareness-Role of NGOs Legislation.	9
II	**ON-SITE STORAGE AND PROCESSING** On-site storage methods – materials used for containers – on-site segregation of solid wastes–public health & economic aspects of storage-source reduction of waste - options under Indian conditions–Critical Evaluation of Options	9
III	**COLLECTION AND TRANSFER** Methods of Collection –Time and frequency of collection-Types of vehicles – manpower requirement– collection routes –Analysis of collection systems - Need for transfer operations-Transfer stations – Selection of location-operation & maintenance-Options under Indian conditions.	9
IV	**OFF-SITE PROCESSING** Objectives of waste processing - Processing techniques and Equipment-Resource recovery from solid wastes–Composting – Incineration – Pyrolysis-Options under Indian conditions	9
V	**DISPOSAL OF SOLID WASTE** Dumping of solid waste-sanitary landfills–Site selection-Design and operation of sanitary landfills–Leachate collection & treatment-Landfill gas management – Landfill closure and post closure environmental monitoring.	9
	Total Instructional Hours	45

Case Study 1: Waste generation status in India.
Case Study 2: GIS application in solid waste management.

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Classify solid waste and determine the effects of poor waste management on public health and the environment
CO2:Assess the options for source reduction of wastes and suggest suitable methods for on-site storage and processing.
CO3: Determine the manpower requirement, collection techniques and transport methodologies of solid waste.
CO4:Compare various techniques of off-site processing and their effectiveness.
CO5:Evaluate the various options for disposal of wastes and their selection criteria.

TEXT BOOKS:

T1-George Tchobanoglous et.al, "Integrated Solid Waste Management", McGraw-Hill Publishers, 2003 T2 - Bilitewski.B, HardHe.G, Marek.K, Weissbach.A, and Boeddicker.H, "WasteManagement", Springer,2004.

REFERENCE BOOKS:

R1-Manual on Municipal Solid Waste Management, "CPHEEO", Ministry of Urban Development, Government of India, New Delhi, 2010.
R2- Landreth.R.E and Rebers.P.A, "Municipal Solid Wastes– problems and Solutions", Lewis Publishers, 2002.
R3 -Bhide.A.D. and Sundaresan.B.B, "Solid Waste Management in Developing Countries", INSDOC, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7304	HAZARDOUS WASTE MANAGEMENT AND SITEREMEDIATION	3	0	0	3

Course Objective

1. To study the sources, types and characteristics of hazardous wastes.
2. To learn the components of hazardous waste management
3. To acquire knowledge on nuclear wastes and E-wastes.
4. To gain knowledge on biomedical and chemical wastes.
5. To understand the design and construction of scientific landfill and site remediation techniques.

Unit	Description	Instructional Hours
	INTRODUCTION	9
I	Need for hazardous waste management –Sources of hazardous wastes – Classification of hazardous waste – Hazardous characteristics - Impacts of hazardous waste on health and environment- Problems in developing countries	
	MANAGEMENT OF HAZARDOUS WASTES	9
II	Basics of hazardous waste management - Components of a hazardous waste management plan -Identifying a hazardous waste –Quantities of hazardous waste generated — Treatment methods –Hazardous waste minimization –Disposal practices in Indian Industries –Future challenges.	
	NUCLEAR WASTES AND E-WASTE	9
III	Characteristics –Types –Nuclear waste –Uranium mining and processing –Power reactors– Refinery and fuel fabrication wastes –spent fuel –Management of nuclear wastes – Decommissioning of Nuclear power reactors – Health and environmental effects.	
	BIOMEDICAL AND CHEMICAL WASTES	9
IV	Biomedical wastes –Types –Management and handling – control of biomedical wastes, Chemical wastes – Sources – Domestic and Industrial – Inorganic pollutants – Environmental effects – Need for control – Treatment and disposal techniques – Physical, chemical and biological processes – Health and environmental effects.	
	THE SCIENTIFIC LANDFILL	9
V	Concept – function – site selection and approval – acceptable wastes – Design and construction – Liners: clay, geomembrane, HDPE, geonet, geotextile –Treatment and disposal of leachate –Combined and separate treatment. Site remediation – Remedial techniques.	
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Classify and categorize hazardous waste and illustrate the impacts of hazardous waste and need of hazardous waste management.

CO2: Propose the various components of hazardous waste management system.

CO3: Summarize the sources, characteristics, impacts and treatment of nuclear and E wastes.

CO4: Summarize the sources, characteristics, impacts and treatment of biomedical and chemical wastes.

CO5: Incorporate scientific approaches to the design and construction of landfills and recommend appropriate site remediation techniques.

TEXT BOOKS:

T1 –Sincero . P and Sincero . A ,"Environmental Engineering " , PHI Learning Pvt. Ltd., 2010.

REFERENCE BOOKS:

R1 - Glynn Henry .j and Gary. W. Heinke, "Environmental Science and Engineering", Prentice Hall of India, 2004.

R2 - Bhide.A.D. and Sundaresan.B.B, "Solid Waste Management in Developing Countries", INSDOC, 2003.

R3 -Biomedical waste (Management and Handling) Rules, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7305	INDUSTRIAL WASTEWATER ENGINEERING	3	0	0	3

Course Objective

1. To gain knowledge on sources, characteristics and impacts of various industrial wastes; their prevention and control; and regulatory requirements
2. To study the various physio-chemical treatment and biological treatment of industrial effluents.
3. To get insight into the advanced wastewater treatment.
4. To understand industrial wastewater generation and treatment with certain case studies.
5. To understand industrial wastewater generation and treatment with certain case studies.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Industrial Wastewater – Characteristics – Environmental Impacts – Effects of Industrial Wastes on Streams, Land – Effluent Standards – Scenario In India – Regulatory Requirements for Industrial Wastewater – Prevention Vs control of Industrial Pollution – Volume Reduction – Process Modification – Strength Reduction – Methods and Materials Changes – Waste minimization Strategies .	9
II	**INDUSTRIAL EFFLUENT TREATMENT** Equalization and Neutralization – separation of Solids - Physio-chemical treatment – Removal of organic and inorganic solids - Individual and Common Effluent Treatment Plants. Biological treatment methods – Aerobic and Anaerobic digestion — Cleaner Technologies and pollution prevention.	9
III	**ADVANCED WASTEWATER TREATMENT** Chemical Oxidation - Ozonation - Photo catalysis - Wet Air Oxidation - Evaporation - Ion exchange – Membrane technologies - Nutrient removal - Land treatment – Well injection. Quantification and characteristics of sludge -thickening, Digestion, Wet combustion - Conditioning, Dewatering and Disposal of Sludge.	9
IV	**CASE STUDIES – 1** Industrial manufacturing process description, wastewater characteristics and effluent treatment flow sheet for Textiles, Sugar mill, distilleries, Thermal power plant, Nuclear power plant, Petroleum refineries, Fertilizers and Dairy.	9
V	**CASE STUDIES –II** Industrial manufacturing process description, wastewater characteristics and effluent treatment flow sheet for Tanneries, Pulp and Paper mill, Chemical industries, Metal finishing industries, Iron and Steel industries, Meatpacking industries and Poultry plant - Industrial estates and Industrial Clusters.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Characterize industrial wastewater and propose methods for prevention and control based on regulatory requirements.

CO2: Schematize various treatment options for industrial wastewater.

CO3: Recommend various advanced treatment methods for industrial wastewater.

CO4:Comprehend and Analyse the industrial wastewater generation, characteristics and treatment based on case studies.

CO5:Comprehend and Analyse the industrial wastewater generation, characteristics and treatment based on case studies.

TEXT BOOKS:

T1-M. NarayanaRao and Amal K. Dutta, "Wastewater Treatment", Oxford & IBH Publishing Co., Pvt.Ltd., New Delhi, 2008.

T2 -D. Barnes, P. J. Buss and B. W. Gould, "Water and Wastewater Systems", Pitman Publishing Inc., Marshfield, 2000.

REFERENCE BOOKS:

R1 - Nemerow N. L., "Industrial Water Pollution", Addison - Wesley Publishing Company Inc., USA, 2001..

R2 - Wesley Eckenfelder Jr. W, "Industrial water pollution control", McGraw Hill book Co, New Delhi, 2001.

R3 -Mahajan S. P. "Pollution Control in process industries", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008.

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PROFESSIONAL ELECTIVE IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7306	DESIGN OF MASONRY AND TIMBER STRUCTURES	3	0	0	3

Course Objective

1. To learn the various types of structures and the design methods.
2. To study the basic concepts in structural design of masonry column and walls.
3. To understand the design of laterally loaded masonry structures.
4. To illustrate the seismic design of masonry structures.
5. To analyse the flexural and compression behaviour of timber structures.

Unit	Description	Instructional Hours
I	STRUCTURE AND DESIGN CONCEPTS Classification of structures-function, material and shape – different structural systems –requirements of structures – stability, strength and stiffness – design methods- working stress method – limit state method of Design – Probabilistic approach to design – load and resistance – codes of practice – choice between different structural materials – concrete, timber, masonry and steel. Structural loads: Dead load – live load – wind load – calculation of wind load for structure –seismic load – buoyancy and thermal loads.	9
II	DESIGN OF MASONRY COLUMN AND WALLS Brick works – Classification of masonry walls - Axially loaded square and rectangular columns with uni-axial eccentricity – solid walls – load bearing walls – axially loaded – eccentrically loaded walls with openings – Non load bearing walls.	9
III	LATERALLY LOADED MASONRY STRUCTURES Structures and loads – stability of masonry – middle third rule – masonry dams – Trapezoidal dams – retaining walls -Load distribution Elements: Bed blocks – spread footings for wall and column – area based on safe bearing capacity.	9
IV	EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES General planning and design – recommendation for masonry wall – behaviour of unreinforced masonry and reinforced masonry walls – limit state design of reinforced brick masonry – lintel band – Free standing walls – Design of shear wall.	9
V	TIMBER: FLEXURAL AND COMPRESSION MEMBERS Factors affecting the strength – permissible stresses – Design for bending, shear and bearing – Flitched beams – solid and built up columns – combined bending and direct stress – wood wall construction.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1:Classify structures and employ suitable method of design.
CO2: Design and detailmasonry column and walls. CO3:Analyze and design laterally loaded masonry structures. CO4:Adopt earthquake resistant design with masonry structures.CO5: Workout the design of timber Structures.

TEXT BOOKS:

T1-Anand. S. Arya, "Masonry and Timber Structures including Earthquake ResistantDesign", Nemchand& Bros.,Roorkee.(U.P).2009.
T2-Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH PublishingHouse, 2017.

REFERENCE BOOKS:

R1-S. UnnikrishnaPillai&DevadassMenon "Reinforced concrete Design", Tata McGraw –Hill PublishingCo., Ltd., Delhi , 2007.
R2-S.K.Duggal, "Earthquake resistant design of structures", Oxford University press, Delhi , 2007

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7307	DISASTER RESISTANT STRUCTURES	3	0	0	3

Course Objective

1. Learn about the different codes of practice for designing a disaster resistant structure.
2. Study the response of different community structures and their reliability assessment.
3. Understand the importance of rehabilitation and retrofitting methods for different disaster.
4. Gain knowledge on modern construction materials, design and construction for reducing the impacts.
5. Assess the damage of structures due to disasters.

Unit	Description	Instructional Hours
	BEHAVIOUR OF LIFE LINE STRUCTURES	
I	Philosophy for design to resist earthquake, cyclone and flood, tsunami, National and International codes of practice, By-Law of urban and semi-urban areas – Traditional and modern structures.	9
II	**COMMUNITY STRUCTURES**	9
	Response of dams, bridges, buildings,Strengthening measures , Safety analysis and rating – Reliability assessment.	
	REHABILITATION AND RETROFITTING	
III	Testing and evaluation - Classification of structures for safety point of view – methods of strengthening for different disasters - qualification test.	9
	DETAILING OF STRUCTURES AND COMPONENTS	
IV		9
	Use of modern materials and their impact on disaster reduction, Use of modern analysis, design and construction techniques optimisation for performance.	
	DAMAGE ASSESSMENT OF STRUCTURES	
V	Damage surveys - Maintenance and modifications to improve hazard resistance - Different types of foundation and its impact on safety - Ground improvement techniques.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Comprehend the codal provisions to analyse and design disaster resistant structures.
CO2: Predict response of different community structures and assess their reliability.
CO3: Propose rehabilitation and retrofitting options.
CO4: Suggest modern materials and analysis for disaster resistant design.
CO5: Assess the damages and suggest suitable maintenance techniques and modifications to improve hazard resistance.

REFERENCE BOOKS:

R1 - V.Moskvin, et.all "Concrete and Reinforced Concrete" - Deterioration and Protection Mir Publishers - Moscow 1983.
R2 - Allen R. T and Edward S. C ,"Repair of Concrete Structures", Blakie and Sons,U.K 2011.
R3 - Proceedings IABSE 14th Congress "Civilisation through Civil Engineering" New Delhi, May 1992.

WEB RESOURCES:

W1 - http://www.cpwd.gov.in/Units/handbook.pdf
W2 -http://unesdoc.unesco.org/images/0015/001504/150454e.pdf

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7308	TALL BUILDINGS	3	0	0	3

Course Objective

1. To make students understand the design philosophies and types of materials to be used for tall buildings.
2. To incorporate the design method of applying loads as per codal provisions.
3. To get exposed to various structural systems and its behaviour.
4. To inculcate various methods to analyze and design the structural elements.
5. To make students know about the stability of the structure against various loading condition.

Unit	Description	Instructional Hours
	INTRODUCTION TO MATERIALS AND DESIGN CRITERIA	
I	Introduction – Materials Used – High Strength Concrete (HSC) – High Performance Concrete (HPC) – Fiber Reinforced Concrete (FRC) – Self Compacting Concrete (SCC) – Glass – High Strength Steel – Development of High Rise Structures – Design philosophies – Planning considerations.	9
	DESIGN LOADS	
II	Gravity Loading – Dead Load – Imposed Load – Live Load Reduction Technique – Impact Load – Seismic Load – Wind Load – Construction Load- Sequential and Lateral Loading – Combinations of Loads – Codal Provisions.	9
	STRUCTURAL SYSTEMS AND ITS BEHAVIOUR	
III	High rise behaviour of various structural systems – Factors affecting the height and structural forms – Structural Systems: Rigid Frames, Braced Frames, Infilled Frames, Shear Walls, Coupled Shear Walls, Wall Frames, Tubular Structures – Cores – Outrigger – Braced and Hybrid Mega Systems.	9
	ANALYSIS AND DESIGN	
IV	Modeling – Approximate and Accurate Analysis – Reduction Techniques – Analysis of buildings as total Structural system – Major subsystem Interaction – Analysis of member forces – Drift and Twist of Structural elements.	9
	STABILITY OF TALL BUILDINGS	
V	Buckling Analysis of Frames – Second order effects of gravity of loading, P – Delta Analysis – Translational Torsional Instability – Stiffness of member in stability – Effect of Foundation Rotation and soil stability.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Gain knowledge about various materials and design criteria.
CO2. Understand the codal provisions of design loads.
CO3. Identify the different structural systems and its behaviour.
CO4. Analysis and design the structural elements.
CO5. Evaluate the importance of stability requirements both on sub structure and super structure.

TEXT BOOKS:

T1- Taranath B. S., "Structural Analysis and Design of Tall Buildings", Tata McGraw Hill Publishing Company Ltd., New Delhi.2012
T2- Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Ltd., NewDelhi.2017.

REFERENCE BOOKS:

R1- Bryan Stafford Smith and Alex Coull, "Tall Building Structures, Analysis and Design", John Wileyand Sons, Inc., 2011.
R2- Wolfgang Schueller, "High Rise Building Structures", John Wiley and Sons, Inc., 1977.
R3- Lynn S. Beedle, "Advances in Tall Buildings", CBS Publishers & Distributors, New Delhi , 1986.

CODE BOOKS:

C1- IS 875 – 1987 (Part 1 – 5) Code of Practice for Design Loads.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7309	FINITE ELEMENT TECHNIQUES	3	0	0	3

Course Objective

1. To understand the finite element analysis, modeling and various principles.
2. To gain knowledge on Element Properties.
3. To be conversant with the concepts of Finite element analysis for one and two dimensional problems.
4. To study about Isoparametric elements and its formulation.
5. To learn the applications of finite element method.

Unit	Description	Instructional Hours
	INTRODUCTION TO FINITE ELEMENT ANALYSIS AND FORMULATION	
I	Basic Concepts of Finite Element Analysis (FEA) and initial value problems – Modeling – Elasticity – Steps in Finite Element Analysis (FEA) – Virtual Work and Variational Calculus Principle – Finite Element Method – Stiffness matrix and Boundary Conditions.	9
	ELEMENT PROPERTIES	
II	Formulation of Stiffness Matrix – Member Approach for Truss and Beam Element - Member Approach for Portal Frame and Grid Element – Solid Elements – Stiffness Matrix of soparametric Elements – Numerical Integration: One, Two and Three Dimensional.	9
	FINITE ELEMENT ANALYSIS OF ONE AND TWO DIMENSIONAL PROBLEMS	
III	Second order equations – Discretization of domain into elements – Generalized coordinates approach – Triangular and Quadrilateral Elements – Extension of Fourth order equation – Derivation of element equations and matrices – Assembly of element equation and matrices – mposition of Boundary Conditions – Solution Techniques.	9
	ISOPARAMETRIC ELEMENTS AND FORMULATION	
IV	Natural Coordinates in 1, 2 and 3 Dimensions – Isoparametric elements in 1, 2 and 3 Dimension – Largrangean and Serendipity Elements – Numerical Elements.	9
	APPLICATIONS OF FINITE ELEMENT METHOD	
V	Finite Elements for Elastic Stability – Finite Elements in Fluid Mechanics – Dynamic Analysis – Bending of Elastic Plates – Time Dependent Problems in Elasticity.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Comprehend the concepts and methods of Finite Element Analysis.
CO2. Formulate the stiffness matrix of the elements.
CO3. Be conversant with the concepts of Finite element analysis for one and two dimensional problems.
CO4. Relate the Isoparametric elements with its formulation.
CO5. Employ finite element methods for various applications.

TEXT BOOKS:

T1- Chandrupatla T. R., and Belegundu A. D., "Introduction to Finite Element in Engineering", Pearson Education Limited, 2014.
T2- Reddy J. N., "An Introduction to Finite Element Method", McGraw – Hill,2006

REFERENCE BOOKS:

R1- Desai and Abel, "Introduction to Finite Element Method", CBS Publishers & Distributors, New Delhi.2005
R2- Krishnamoorthy C.S., "Finite Element Analysis – Theory & Programming", McGraw – Hill.2007
R3- Rao S. S., "The Finite Element Method in Engineering", Pergaman Press, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7310	PREFABRICATED STRUCTURES	3	0	0	3

Course Objective

1. To learn the basic principles of prefabrication.
2. To understand the various elements of prefabricated structures.
3. To gain knowledge on dimensioning and detailing of joint.
4. To get an exposure on design principles of prefabricated units
5. To acquire the knowledge on production methodologies of prefabricated structures.

Unit	Description	Instructional Hours
I	GENERAL PRINCIPLES OF FABRICATION Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication - Economy of prefabrication – Modular coordination – Standardization – Planning for Components of prefabricated structures –Disuniting of structures – Handling and erection stresses –Elimination of erection stresses – Beams, columns - Symmetrical frames.	9
II	PREFABRICATED ELEMENTS Roof and floor panels, ribbed floor panels – wall panels – footings – Joints for different structural connections– Effective sealing of joints for water proofing – Provisions for non-structural fastenings – Expansion joints in pre-cast construction.	9
III	JOINTS IN STRUCTURAL MEMBERS Joints for different structural connections – Dimensions and detailing– Design of expansion joints.	9
IV	DESIGN OF PRE FABRICATED UNITS Prefabricated units for Industrial structures, Multi-storied buildings and Water tanks etc., Application of pre stressed concrete in prefabrication.	9
V	PRODUCTION TECHNOLOGY Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup– Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Comprehend the principles and concepts of prefabrication.
CO2: Categorize the various prefabricated element and know their jointing details.CO3: Design of the connections and joints of prefabricated structures.
CO4: Analyse and design structural units for various prefabricated structures.CO5: Comprehend the production methods of prefabricated elements.

TEXT BOOKS:

T1- Hubert Bachmann, Alfred Steinle, "Precast Concrete Structures", Ernst and Sohn GMBH & Co., K.G., 2011.

T2- "Structural design manual", Precast concrete connection details, Society for the studies inthe use of precast concrete, Netherland BetorVerlag, 2009.

REFERENCE BOOKS:

R1- B.Lewicki, "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam / London /New York, 2011.

R2- Levit, M. ,"Precast concrete materials, Manufacture properties and usage", Applied Science Publishers, London , 2007.

R3- Kim S. Elliott, "Precast Concrete Structures" Butter – Heinemann, 2016.

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PROFESSIONAL ELECTIVE V

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8301	COMPUTER AIDED DESIGN OF STRUCTURES	3	0	0	3

Course Objective

1. To gain knowledge onthe hardware and software components in CAD system.
2. To understand the modeling concepts of computer graphics.
3. To study the principles of structural analysis and concepts of Finite Element Analysis.
4. To understand the design principles and optimize the design.
5. To gain insight into expert systems, its rules and decision tables.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Fundamental Reasons for implementing CAD – Hardware and Software components and requirements in CAD systems – Design Process – Application and Benefits.	9
	COMPUTER GRAPHICS	
II	Graphic software and primitives – 2D and 3D Transformations – Concatenations – Wire Frame and Solid Modeling – Graphic Standards – Auto CAD.	9
	ANALYSIS	
III	Principles of structural analysis and finite element analysis – Stiffness matrix formulation – Variational and Weighted residual methods (Problems) – Analysis packages and applications.	9
	OPTIMIZATION OF DESIGN	
IV	Principles of design of steel and RC structural members – Applications to simple design problems – Optimization techniques – Algorithms and Linear Programming.	9
	EXPERT SYSTEMS	
V	Artificial Intelligence – Knowledge based expert systems (KBES) – Applications of KBES – Rules and decision tables – Inference to mechanisms – Simple applications.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Justify the applications of hardware and software components in design.
CO2. Implement the modeling concepts of graphic standards.
CO3. Apply principles of structural analysis and finite element analysis and formulate stiffness matrix.
CO4. Optimize the design of structural elements with all stability requirements.
CO5. Employ expert systems for various applications.

TEXT BOOKS:

T1- Groover M. P. and Zimmers E. W., "CAD/CAM Computer Aided Design and Manufacturing",Prentice Hall of India Ltd, New Delhi, 2008.
T2- Krishnamoorthy C.S., "Finite Element Analysis – Theory & Programming", McGraw - Hill.2007

REFERENCE BOOKS:

R1- Krishnamoorthy C.S. and Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 2008.
R2- Rao S.S., "Optimization Theory and Applications", Wiley Eastern Ltd, New Delhi, 200

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8302	DESIGN OF INDUSTRIAL STRUCTURES	3	0	0	3

Course Objective

1. To understand the planning and classification of various industries.
2. To study the functional requirements of industrial structures.
3. To get accustomed to the design of steel structures in various industries.
4. To gain knowledge on the design of industrial RC structures.
5. To learn the design of Power Transmission line structures.

Unit	Description	Instructional Hours
	PLANNING	
I	Classification of Industries and Industrial structures –General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components	9
	FUNCTIONAL REQUIREMENT	
II	Lighting – Ventilation – Accounts – Fire safety – Guidelines from factories act.	8
	DESIGN OF STEEL STRUCTURES	
III	Industrial roofs – Crane girders - Design of Bunkers and Silos.	8
	DESIGN OF R.C. STRUCTURES	
IV	Silos and bunkers – Chimneys – Principles of folded plates and shell roofs.	9
	POWER TRANSMISSION STRUCTURE	
V	Towers - Tower foundation - Classification and types of foundation - Testing of towers - Loads of transmission line towers - Foundation of TL towers Forces - on tower foundation - Types of substation - Power cables and control cables types of repair techniques.Retrofitting/Strengthening: Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening structures. Seismic retrofit of concrete structures.	11
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Evaluate the planning requirements for industries.
CO2: Sort out functional requirements for industries.
CO3: Design industrial structures with steel.
CO4: Design industrial structures with RCC.
CO5: Workout the design of Power Transmission Structures.

TEXT BOOKS:

T1 - KrishnaRaju. N "Structural Design and Drawing: Reinforced Concrete and Steel", University Press (India)Pvt Limited, 2009.

T2 – Punmia B. C , Ashok Kr. Jain, "Limit State Design of Reinforced Concrete ", 2007.T3 - Duggal, "Design of Steel Structures", Tata McGraw-Hill Education, 2009.

REFERENCE BOOKS:

R1 - Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 2010.

R2 - Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990.

R3 - Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982.

CODE BOOKS:

C1 - IS:802 - Part III - 1978, IS Code of practice for use of structural steel in over head transmission line tower ,BIS, New Delhi.

C2 - IS:4091-1979, IS Code of practice for design and construction of foundations for transmission line towersand poles, BIS, New Delhi.

C3 - IS:6533 – Part II- 1989, IS code of practice for design and construction of steel Chimney, BIS, New Delhi.

C4 - IS:6332 - 1984, IS Code of practice for construction of floors & roofs using precast double curved shellunits, BIS, New Delhi.

C5 - IS:2204 - 1962, Code of practice for construction of reinforced concrete shell roof, BIS, New Delhi.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8303	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	3	0	0	3

Course Objective

1. To understand the basic concepts of prestressing.
2. To gain knowledge on the design principles of prestressed concrete.
3. To get exposed to design of prestressed concrete tanks and pipes.
4. To learn how to analyze the composite members.
5. To acquire knowledge on design of prestressed concrete bridges.

Unit	Description	Instructional Hours
	THEORY AND BEHAVIOUR	
I	Basic concepts – advantages – materials required – systems and methods of prestressing – analysis of sections – stress concept – strength concept – load balancing concept – effect of loading on the tensile stresses in tendons – effect of tendon profile on deflections – factors influencing deflections – calculation of deflections – short term and long term deflections - losses of prestress – estimation of crack width.	9
	DESIGN CONCEPTS	
II	Flexural strength – simplified procedures- codal provision – strain compatibility method – basic concepts in selection of cross section for bending – stress distribution in end block - design of anchorage zone reinforcement – limit state design criteria – partial prestressing – applications.	9
	CIRCULAR PRESTRESSING	
III	Introduction – General features of prestressed concrete tanks –Analysis and Design of prestressed concrete tanks – Design of cylindrical and non-cylindrical pipe.	9
	COMPOSITE CONSTRUCTION	
IV	Types - Analysis for stresses –Differential shrinkage - estimate for deflections – flexural and shear strength of composite members.	9
	PRE-STRESSED CONCRETE BRIDGES	
V	General aspects –Advantages –pretensionedprestressed concrete bridge decks – Post tensioned prestressed concrete bridge decks – Principles of design only.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Incorporate the basic fundamentals of prestressing in civil engineering.
CO2: Design prestressed concrete flexural members.
CO3: Apply the design concept of prestressed concrete tanks and pipes.
CO4: Evaluate the performance of composite members.
CO5: Design pretensioned and prestressed concrete bridges.

TEXT BOOKS:

T1- Krishna Raju N., "Prestressed concrete", Tata McGraw Hill Company, New Delhi, 2012.
T2- Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.

REFERENCE BOOKS:

R1- Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2010.
R2- Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
R3- Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley IndiaPvt. Ltd., New Delhi, 2013.

CODE BOOKS:

C1- IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012
C2- IS3370: 1967(part 1 to 4), Code of practice for concrete structures for the storage of liquids, New Delhi, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8304	REPAIR AND REHABILITATION OF STRUCTURES	3	0	0	3

Course Objective

1. To get awareness on maintenance and repair strategies.
2. To understand the strength and durability of concrete.
3. To gain knowledge on special concretes.
4. To learn the various repair techniques and corrosion protection methods.
5. To acquire knowledge on repair, rehabilitation and retrofitting of structures.

Unit	Description	Instructional Hours
	MAINTENANCE AND REPAIR STRATEGIES	
I	Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.	9
	STRENGTH AND DURABILITY OF CONCRETE	
II	Quality assurance for concrete - Strength, Durability and Thermal properties of concrete - Cracks, different types, causes – Effects due to climate, temperature, chemicals, Design and construction errors, Effects of cover thickness	9
	SPECIAL CONCRETES	
III	Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.	9
	TECHNIQUES FOR REPAIR AND PROTECTION METHODS	
IV	Non-destructive Testing Techniques, Epoxy injection, shotcrete, Gunite, Shoring, Underpinning - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, rust eliminators.	9
	REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES	
V	Need for retrofitting - Techniques available for strengthening of structural elements - Repair of structures distressed due to corrosion, fire, leakage, earthquake - Demolition techniques - Engineered demolition methods - - Case studies.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Recollect the facets and importance of maintenance and also know how to evaluate a damaged building.

CO2: Deduce the factors affecting the quality of concrete.

CO3: Suggest special concretes for various applications.

CO4: Interpret the principles of non-destructive testing and implement the latest techniques in the repair and corrosion protection methods.

CO5: Recommend suitable techniques for repair, rehabilitation and retrofitting of structures.

TEXT BOOKS:

T1 -Allen R.T. and Edwards S.C, Repair of Concrete Structures, Spon Press (Taylor & Francis group), 2005.
T2 -Modi P. I and C. N. Patel, Repairs and rehabilitation of concrete structures , PHI Publication, 2016.
T3 - Thomas Telford,"Repair and Strengthening of Concrete structures", FIP guide ,London, 1991.

REFERENCE BOOKS:

R1 -Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2008.
R2 -Dov Kominetzky, "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2008.
R3 -Amarnath C, Devdas Menon, Amlan Kumar S, Hand book on Seismic Retrofit of Buildings, Alpha Science International Limited, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8305	VALUATION OF LAND AND BUILDINGS	3	0	0	3

Course Objective

1. To understand the fundamentals of valuation.
2. To study the characteristics of land and the various theories of land valuation.
3. To learn the different methods of valuation of immovable properties
4. To explore the various techniques of building valuation
5. To get conversant with the principles and methods of rental valuation and depreciation.

Unit	Description	Instructional Hours
	FUNDAMENTALS OF VALUATION	
I	Basic concepts of valuation in India – Concepts of ownership – value and property – Types of property – Factors affecting value of the property – cost – price – value – Uncertainty in value estimation - Types of values – Elements of valuation – types of properties - Basics for successful valuer – Ethics for valuers - valuation report.	9
	CLASSIFICATION OF LAND AND ITS CHARACTERISTICS	
II	Characteristics of land – Infrastructure amenities – Land area – Residential and Industrial use –Frontage - zoning rules – Theories of land valuation – Recessed land concept – Land locked land concept - Belting theory – Hypothetical plotting scheme.	9
	VALUATION METHODS	
III	Methods of valuation : Land and building method, Rent capitalization method , Development method , Profit method , Composite rate method - Investment method of valuation – Discount cash flow – Net present value and internal rate of return method – profit method of valuation – cinema – petrol pump – Hotel and marriage hall valuation – Business valuation – income tax – wealth tax - case studies in valuation.	9
	VALUATION APPROACH	
IV	Residual technique – owner and tenant occupied – Hypothetical building scheme – Income and ownership concept – rental , profit , cash flowtechnique – Limitation of market approach – Belting – Historic cost – formula for workout net present value – method of estimating building cost – book value method – cost index method – Book value , flat rate, cost index – Detailed quantity method.	9
	METHODS OF DEPRECIATION	
V	Rental method of valuation – form of rent – different types of rent – standard rent – depreciation – different methods of calculating depreciation – straight line method, linear method – sinking fund method – declining balance method – quantity survey method – depreciation cost – obsolescence – Estimation and preparation of bills.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Employ the fundamental principles of valuation while evaluating a property.
CO2: Apply the various theories and concepts of valuation when evaluating a land.
CO3: Compare and contrast the various methods of valuation of immovable properties.
CO4: Work out the net present value and estimate the cost of buildings.
CO5: Estimate the rent and depreciation values of various properties.

TEXT BOOKS:

T1- R.K. Gandhi, "Elements of Valuation of Immovable Properties",Tata McGraw –Hill PublishingCo., Ltd., Delhi , 2013.
T2- Rangwala S. C, "Valuation of Real Properties", Charotar publishing house, India, 2015.

REFERENCE BOOKS:

R1- Kanagasabapathy .B, K.Arun, Practical valuation volume - I
R2- Roshan Nannavati , Professional practice (Estimation and valuation), U.B.S Publishers & Distributors Pvt. Ltd. New delhi , 2000.
R3- C.P.W.D. Specifications and Schedule of rates.

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PROFESSIONAL ELECTIVE VI

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8306	GROUNDWATER ENGINEERING	3	0	0	3

Course Objective

1. To study the various hydrogeological parameters.
2. To enhance the knowledge on well hydraulics
3. To understand the origin, movement and quality of groundwater.
4. To learn the need and development of models for groundwater management.
5. To gain insight into the various groundwater conservation techniques, GW pollution and legislation.

Unit	Description	Instructional Hours
	HYDROGEOLOGICAL PARAMETERS	
I	Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation– Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.	9
	WELL HYDRAULICS	
II	Objectives of Groundwater hydraulics – Darcy's Law - Groundwater equation – steady state flow - Dupuit Forchheimer assumption - Unsteady state flow – Thiem's method - Jacob method -Slug tests - Image well theory – Partial penetrations of wells.	9
	GROUNDWATER QUALITY	
III	Groundwater chemistry – Origin, Movement and Quality – Water quality standards – Health and Aesthetic aspects of water quality – Saline intrusion – Environmental concern in regulatory requirements.	9
	GROUNDWATER MANAGEMENT	
IV	Need for Management Model – Database for groundwater management –groundwater balance study – Introduction to Mathematical model – Conjunctive use – Collector well and Infiltration gallery.	9
	GROUNDWATER CONSERVATION	
V	Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation, Contamination source inventory, remediation schemes - Ground water Pollution and legislation.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1 – Comprehend the various hydrogeological parameters.
CO2 – Be conversant with well hydraulics and estimate the yield of aquifers.
CO3 - Interpret the groundwater quality in relation to health and aesthetic aspects.
CO4 –Apply various models for groundwater management.
CO5 –Suggest and adopt suitable groundwater conservation techniques.

TEXT BOOKS:

T1 - Raghunath H.M., " Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.T2 - Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2011.

REFERENCE BOOKS:

R1 - Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2012.R2 - Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8307	INTEGRATED WATER RESOURCES MANAGEMENT	3	0	0	3

Course Objective

1. To learn the concepts of IWRM.
2. To study about the water economics.
3. To understand the relation between water supply and health within the IWRM consideration
4. To gain basic knowledge on agriculture in the concept of IWRM.
5. To understand the principles of international and national law in the area of water management.

Unit	Description	Instructional Hours
	CONTEXT FOR IWRM	
I	Water as a global issue: key challenges and needs - Definition of IWRM within the broader context of development - Complexity of the IWRM process - Examining the key elements of IWRM process.	8
	WATER ECONOMICS	
II	Economic view of water issues: economic characteristics of water and services –Non market monetary valuation methods - Water economic instruments, policy options for water conservation and sustainable use - Case studies. Pricing: distinction between values and charges - Private sector involvement in water resources management: (Public-Private Partnership)PPP objectives, PPP options, PPP processes, PPP experiences through case studies - Links between PPP and IWRM.	10
	WATER SUPPLY AND HEALTH WITHIN THE IWRM CONSIDERATION	
III	Links between water and human health: options to include water management interventions for health - Health protection and promotion in the context of IWRM - Health impact assessment of water resources development.	10
	AGRICULTURE IN THE CONCEPT OF IWRM	
IV	Water for food production: blue versus greenwater debate - Virtual water trade for achieving global water security - Irrigation efficiencies, irrigation methods and current water pricing.	8
	WATER LEGAL AND REGULATORY SETTINGS	
V	Basic notion of law and governance: principles of international and national law in the area of water management. Understanding UN law on non - navigable uses of international water courses - Development of IWRM in line with legal and regulatory framework.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Incorporate the concept of IWRM process.
CO2: Implement theeconomic characteristics of water and services
CO3: Know the concept of Health protection and promotion in the context of IWRM
CO4: Access the irrigation efficiencies, irrigation methods and current water pricing.
CO5: Understand the importance of development of IWRM in line with legal and regulatory framework.

TEXT BOOKS:

T1 –Negi S. S ," Integrated Watershed Management", Oriental Enterprises, 2001.
T2 -Cech Thomas V., |"Principles of Water Resources: History, Development, Management and Policy", John Wiley and Sons Inc., New York, 2003.

REFERENCE BOOKS:

R1 - Technical Advisory Committee, "Integrated Water Resources management", Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
R2 - Technical Advisory Committee, Regulation and Private Participation in Water and Sanitation section, Technical Advisory Committee Background paper No-1. Global water partnership, Stockholm, Sweden, 1998.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8308	ROCK ENGINEERING	3	0	0	3

Course Objective

1. To study the geological classification and index properties of rocks
2. To learn the laboratory and field measurement of rock strength and the failure mechanisms.
3. To enhance the knowledge on stresses in rocks and their measurement.
4. To acquire knowledge on application of rock mechanics.
5. To understand various methods of Rock bolting.

Unit	Description	Instructional Hours
I	**CLASSIFICATION AND INDEX PROPERTIES OF ROCKS** Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.	9
II	**ROCK STRENGTH AND FAILURE CRITERIA** Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength – Stress strain behaviour in compression – Mohr-coulomb failure criteria and empirical criteria for failure – Deformability of rock.	9
III	**INITIAL STRESSES AND THEIR MEASUREMENTS** Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – technique for measurements of in-situ stresses.	9
IV	**APPLICATION OF ROCK MECHANICS IN ENGINEERING** Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.	9
V	**ROCK BOLTING** Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability toCO1 – Classify rocks and comment on index properties of rocks
CO2 – Determine the rock strength and evaluate the rock failure mechanisms CO3 - Estimate the stresses in rocks and describe techniques for measurement..CO4 – Apply rock mechanics in engineering.
CO5 – Comprehend the installation of rock bolts.

TEXT BOOKS:

T1 - Goodman P.E., "Introduction to Rock Mechanics", John Wiley and Sons, 2010.
T2 - Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications, 1996.

REFERENCE BOOKS:

R1 - Brow E.T., "Rock Characterisation Testing and Monitoring", Pergaman Press, 2000.
R2 - Arogyaswamy R.N.P., "Geotechnical Application in Civil Engineering", Oxford and IBH, 2011.R3 - Hock E. and Bray J., "Rock Slope Engineering, Institute of Mining and Metallurgy", 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8309	GROUND IMPROVEMENT TECHNIQUES	3	0	0	3

Course Objective

1. Study the role and methods of ground improvement and the geotechnical problems in soils.
2. Explore the application of engineering methods to improve the engineering properties of soil.
3. Gain knowledge in existing insitu treatment of cohesive and cohesion less soil.
4. Gather information on how to use geotextile in various functions such as filtration, drainage, and separation in highway projects.
5. Understand the principles of grouting methods, techniques and machinery.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.	9
	DRAINAGE AND DEWATERING	
II	Drainage techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).	9
	INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOIL	
III	Insitu densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.	9
	EARTH REINFORCEMENT	
IV	Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.	9
	GROUT TECHNIQUES	
V	Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring, Stabilization with cement, lime and chemicals - Stabilization of expansive soils.	9
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Interpret the geotechnical problem and select suitable method for ground improvement.
CO2: Implement drainage and dewatering techniques for improving the properties of soil
CO3: Apply the concepts of insitu treatment methods for ground improvement
CO4: Select and use a suitable geosynthetic material for various functions.
CO5: Employ suitable grouting techniques and other soil stabilization methods for ground improvement.

TEXT BOOKS:

T1 - Purushothama Raj, P. "Ground Improvement Techniques", Laxmi publication, New Delhi, 2016.
T2 – Bikash Chandra chattopadyay and Joyantamaity, " Ground improvement techniques" PHI learning private Ltd, Delhi, 2017.

REFERENCE BOOKS:

R1 - Peter. G. Nicholson, " Soil improvement and ground modification methods",Elsevier Inc, 2015R2 - Jones J.E.P., "Earth Reinforcement and Soil Structure", Butterworths, 2004.
R3 –Raison C. A ,"Ground and soil improvement", Thomas Telford publishing, 2000

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8310	EARTH RETAINING STRUCTURES	3	0	0	3

Course Objective

1. To understand the theories of earth pressure, techniques and methods to determine the earth pressure.
2. To gain knowledge on compaction, drainage and stability conditions of earth retaining structures.
3. To learn the analysis and design of sheet pile walls and cofferdams.
4. To study the various types of supported excavation, soil anchors and conduits.
5. To get conversant with the design procedure of reinforced earth retaining structures.

Unit	Description	Instructional Hours
	THEORIES OF EARTH PRESSURE	
I	Introduction - State of stress in retained soil mass - Earth pressure theories - Classical and graphical techniques -Active, passive and at rest cases, empirical methods - Wall movement and complex geometry, Earth pressure due to external loads	9
	COMPACTION, DRAINAGE AND STABILITY CONSIDERATION	
II	Lateral pressure due to compaction - strain softening - wall flexibility - influence of drainage - pressure due to earthquake forces – Stability of retaining structures – Application of geosynthetics in earth structures.	9
	SHEET PILE WALLS AND COFFERDAM	
III	Lateral pressure on sheeting in braced excavation - Analysis and design of cantilever and anchored sheet pile walls - Cofferdam: design in rock and soil strata. Types of sheet pile walls – Types of cofferdam	9
	SUPPORTED EXCAVATIONS	
IV	Lateral pressure on sheeting in braced excavation - stability against piping and bottom heaving - earth pressure around tunnel lining, shaft and silos - Basic design concepts.	9
	REINFORCED EARTH RETAINING STRUCTURES	
V	Reinforced earth retaining wall – principles, concepts and mechanism of reinforced Earth – Stability of retaining structure - Design consideration of reinforced earth – Design of cantilever and counterfort retaining wall.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Consider various theories, cases and methods to calculate the earth pressure.
CO2: Take into account the various soil parameters and design the retaining structures.
CO3: Analyze and design sheet pile walls and cofferdams.
CO4: Compare and contrast the various types of supported excavation, soil anchors and conduits.
CO5: Analyze and design the reinforced earth retaining structures.

TEXT BOOKS:

T1 - Gopal Ranjan and A. S. Rao, "Basic and Applied Soil Mechanics", New Age International, 2016.T2 - Das B. M, Principles of Geotechnical Engineering, The PWS Series in Civil Engineering, 2016.

REFERENCE BOOKS:

R1 – Day R. W,"Geotechnical and Foundation Engineering: Design and Construction", McGraw Hill,2000.
R2 – Bowles J. E, "Foundation Analysis and Design", TMI, 2010.
R3 -Swami Saran, Analysis and Design of Substructures, Oxford & IBH Publishing Company Pvt. Ltd.,2006.

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OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7402	STRATEGIES OF GREEN BUILDINGS	3	0	0	3

Course Objective

1. Understand the role green building plays in the context of climate change, energy scarcity,materials, and carbon.
2. Make the students conversant with the importance of life cycle analysis for construction materials.
3. Emphasize the concept of science behind green buildings.
4. Learn about green building incentive programs, certification programs, and local, state and federalpolicies.
5. Gain exposure to the methods of green remodeling, retrofit and management of green projects.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO GREEN BUILDING** Green building concept – Ethics and Sustainability – Effect on Climate Change – Solution toinsufficient energy resource - Carbon Foot Print – Design Features.	8
II	**ALTERNATIVE CONSTRUCTION MATERIALS** Building and Material Reuse – Salvaged Materials – Material Content – Manufactured Materials – Recycled Content – Volatile Organic Compounds (VOC) – Alternative Systems – Waste Management – Design for Deconstruction.	10
III	**STRATEGIES OF GREEN BUILDING** Design Strategies – Urban and Site Design – Energy Efficiency – Renewable Energy –Building Materials – Water Issues – Indoor Environment – Integrated Building Design – Environmental Criteria and Factors.	8
IV	**EVALUATION AND RATING SYSTEMS OF GREEN BUILDING** Building Modeling & Energy Analysis – Cost Benefit Analysis – Testing and Verification –Commissioning – Metering and Monitoring – Weatherization – Green Rating Systems – LEED as per IGBC and USGBC – GRIHA as per TERI – Codes and Certification Programs –Incentives and Other Benefits	11
V	**GREEN RETROFITS, REMODELS AND PROJECT MANAGEMENT** Inspection and Evaluation – Deep Energy Retrofits – Green Remodel Ratings –Documentation – Certification – Methods and Management Practices.	8
	Total Instructional Hours	45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1. Incorporate the concepts of green building and reduce carbon foot print.

CO2. Identify and compare cost and performance of building materials with recycled components,materials with low embodied energy and salvaged materials and incorporate them into design.

CO3. Integrate the importance of green building strategies and science in construction.

CO4. Understand the techniques and benefits of building monitoring and metering and also identify andcompare the existing energy codes with green building codes and rating systems.

CO5. Recognize and demonstrate methods for green remodeling and management and green ratingsystem compliance.

TEXT BOOKS:

T1 -Kibert C, "Sustainable Construction: Green Building Design and Delivery" John Wiley & Sons, 2005. T2 -McDonough W and Braungart M, "Cradle to Cradle: Remaking the Way We Make Things", AffiliatedPress Pvt. Ltd., New Delhi, 2000.

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REFERENCE BOOKS:

R1 -M Bauer P Mosle and M Schwarz, "Green Building: Guidebook for Sustainable Architecture",Springer – Verlag Berlin Heidelberg, 2010.
R2 - Jerry Yudelson, "Guide for Engineering, Construction and Architecture", The Fairmont Press Inc.,2006.
R3 - Angela M Dean, "Green by Design: Creating a Home for Sustainable Living", Gibbs SmithPublication, 2003.

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Coimbatore - 641 032

DEPARTMENT OF CIVIL ENGINEERING

For the students studying in the academic year 2019 – 2020

19HE1101-TECHNICAL ENGLISH

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Average	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

19MA1102-CALCULUS AND LINEAR ALGEBRA

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
Average	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

19PH1151-APPLIED PHYSICS

19PH1151	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Average	3	2.2	2	1.6	2	1.33	-	-	-	-	-	1	2.4	2.4

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19CY1151- CHEMISTRY FOR ENGINEERS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Average	3	2	2	2	2	1	1	-	-	-	-	1	1	1

19CS1151-PYTHON PROGRAMMING AND PRACTICES

19CS1151	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Average	2	3	3	-	2	-	-	-	2	-	-	2	2	2

19ME1152-ENGINEERING DRAWING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	-	1	-	1	-	-	1	1	1	1	2
CO2	3	3	2	1	1	-	1	-	-	1	1	1	1	2
CO3	3	3	3	-	1	1	1	-	-	1	1	-	1	1
CO4	3	3	3	1	1	2	1	-	-	1	1	1	1	1
CO5	3	3	3	1	1	3	1	-	-	1	1	1	1	1
Average	2.8	3	2.6	1	1	2	1	-	-	1	1	1	1	1.4

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16CE4201 – STRENGTH OF MATERIALS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO2	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO3	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO4	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO5	3	3	3	2	1	-	-	-	-	-	1	3	3	3
Average	**3.0**	**3.0**	**3.0**	**2.0**	**1.0**	-	-	-	-	-	**1.0**	**3.0**	**3.0**	**3.0**

16CE4202 – APPLIED HYDRAULICS AND HYDRAULIC MACHINERY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	2	-	1	2	1	3	2	3
CO2	3	2	2	2	1	3	2	1	1	2	-	3	2	2
CO3	3	2	1	2	2	1	1	1	2	1	3	2	3	3
CO4	3	3	3	2	1	3	1	-	1	2	2	3	2	3
CO5	3	3	3	2	1	3	2	1	1	-	1	3	3	3
Average	**3.0**	**2.4**	**2.0**	**2.0**	**1.3**	**2.2**	**1.6**	**1.0**	**1.2**	**1.8**	**1.8**	**2.8**	**2.4**	**2.8**

16CE4203 – SOIL MECHANICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	1	-	2	2	1	1	3	3	3
CO2	3	3	3	1	2	1	-	1	1	1	-	3	3	3
CO3	3	2	3	2	1	2	-	1	2	1	-	3	3	3
CO4	3	3	3	3	2	3	1	3	1	2	3	3	3	3
CO5	3	3	3	2	1	1	-	2	1	1	-	3	3	3
Average	**3.0**	**2.8**	**2.8**	**2.0**	**1.8**	**1.6**	**1.0**	**1.8**	**1.4**	**1.2**	**2.0**	**3.0**	**3.0**	**3.0**

16CE4204 – SURVEYING II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	1	1	1	1	1	1	1	1	1
CO2	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO3	2	1	-	1	3	1	2	1	1	1	1	1	1	1
CO4	2	1	1	1	2	1	-	-	1	-	-	1	1	1
CO5	2	1	1	1	2	1	2	1	1	1	1	1	1	1
Average	**2.0**	**1.2**	**1.0**	**1.0**	**2.2**	**1.0**	**1.5**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**

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16CE4205 – HIGHWAY AND RAILWAY ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	1	-	1	1	1	1	2	1	2
CO2	3	2	3	3	3	1	1	1	1	1	1	2	1	2
CO3	3	2	3	3	3	1	1	1	-	-	1	2	1	2
CO4	3	2	3	3	3	1	1	1	1	1	1	2	1	2
CO5	3	2	3	3	3	1	1	1	1	1	1	2	1	2
Average	**3.0**	**2.0**	**2.8**	**2.8**	**3.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**1.0**	**2.0**

16CE4001 – STRENGTH OF MATERIALS LABORATORY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO2	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO3	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO4	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO5	3	3	3	2	2	-	-	-	1	-	2	3	3	3
Average	3.0	3.0	3.0	2.0	2.0	-	-	-	1.0	-	2.0	3.0	3.0	3.0

16CE4002 – FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	3	2	3	3	1	1	2	3	3
CO2	3	2	-	2	1	3	3	3	3	1	-	2	2	2
CO3	3	2	1	2	1	3	2	3	3	1	1	2	3	3
CO4	3	3	3	2	1	3	2	3	3	1	2	2	3	3
CO5	3	3	3	2	1	3	2	3	3	2	1	2	3	2
Average	3.0	2.4	2.0	2.0	1.0	3.0	2.2	3.0	3.0	1.2	1.3	2.0	2.8	2.6

16CE5201 – STRUCTURAL ANALYSIS–I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO2	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO3	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO4	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO5	3	3	1	2	1	2	-	-	-	-	1	3	3	3
Average	3.0	3.0	1.0	2.0	1.0	2.0	-	-	-	-	1.0	3.0	3.0	3.0

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16CE3203 - CONSTRUCTION MATERIALS, EQUIPMENT ANDPRACTICES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	3	-	2	1	3	1	3	3	2
CO2	3	2	3	2	-	2	1	1	1	2	1	3	3	2
CO3	3	3	1	2	1	3	2	1	2	3	1	3	3	2
CO4	3	2	3	2	2	2	-	2	2	1	1	3	2	2
CO5	3	2	3	2	2	2	-	2		2	2	3	2	3
Average	3.0	2.0	2.4	2.0	1.7	2.4	1.5	1.6	1.5	2.2	1.2	3.0	2.6	2.2

16CE3204 – SURVEYING –I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1	1	1	2	1	1	1	3	2	1
CO2	3	2	1	2	1	1	1	1	1	1	1	2	1	1
CO3	3	2	1	2	1	1	1	1	1	1	1	3	2	2
CO4	3	2	1	2	1	1	1	1	1	1	1	3	2	2
CO5	2	2	1	2	1	1	1	2	1	1	1	3	2	1
Average	2.6	2.0	1.0	2.0	1.0	1.0	1.0	1.4	1.0	1.0	1.0	2.8	1.8	1.4

16CE3205 – ENVIRONMENTAL SCIENCE AND ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	2	3	-	-	-	1	1	1	2
CO2	2	2	1	-	-	2	2	-	-	-	1	1	2	2
CO3	2	2	1	-	1	2	2	-	-	-	1	1	2	2
CO4	2	2	1	-	-	3	2	-	-	-	1	2	1	2
CO5	1	1	1	-	1	2	2	-	-	-	1	2	1	2
Average	1.6	1.6	1.0	-	1.0	2.2	2.2	-	-	-	1.0	1.4	1.4	2.0

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16CE3001 – SURVEY LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1	-	1	3	3	1	2	2	2
CO2	2	2	1	1	3	1	-	1	3	3	1	2	2	2
CO3	2	2	1	1	3	1	-	1	3	3	1	2	2	2
CO4	2	2	1	1	2	1	-	1	3	3	1	2	2	2
CO5	2	2	1	1		1	-	1	3	3	1	2	2	2
Average	**2.0**	**2.0**	**1.0**	**1.0**	**2.5**	**1.0**	**-**	**1.0**	**3.0**	**3.0**	**1.0**	**2.0**	**2.0**	**2.0**

16CE3002 –COMPUTER AIDED BUILDING DRAWING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	3	1	-	-	2	1	2	2	3	3
CO2	2	2	2	1	3	1	-	-	2	1	2	2	3	2
CO3	2	2	1	1	3	1	-	-	1	1	2	2	2	2
CO4	3	3	3	2	3	1	-	-	2	1	2	2	3	1
CO5	1	1	2	1	3	1	-	-	2	1	1	1	2	2
Average	2.0	2.0	2.0	1.2	3.0	1.0	-	-	1.8	1.0	1.8	1.8	2.6	2.0

16MA4110 - APPLIED PROBABILITY AND STATISTICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2	2	1	2	2	2	1	2	2
CO2	2	2	2	3	2	2	2	1	2	2	2	1	2	2
CO3	3	3	3	1	3	3	3	1	3	3	3	1	3	3
CO4	1	1	1	2	1	1	1	1	1	1	1	1	1	1
CO5	2	2	2	2	2	2	2	1	2	2	2	1	2	2
Average	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**1.0**	**2.0**	**2.0**	**2.0**	**1.0**	**2.0**	**2.0**

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16MA3104-FOURIER ANALYSIS AND NUMERICAL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2	1	-	-	-	-	-	-	2	2	2
CO3	2	3	2	2	1	-	-	-	1	-	-	1	2	2
CO4	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO5		2		2	1	-	-	-	-	-	-	1		2
Average	2.5	2.4	2.5	2.0	1.0	-	-	-	1.0	-	-	1.6	2.1	2.0

16CE3201- MECHANICS OF SOLIDS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO2	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO3	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO4	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO5	3	3	3	2	1	-	-	-	-	-	1	3	3	3
Average	3.0	3.0	3.0	2.0	1.0	-	-	-	-	-	1.0	3.0	3.0	3.0

16CE3202-MECHANICS OF FLUIDS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	1	3	-	1	1	1	3	3	3
CO2	3	2	1	1	-	1	2	1	1	1	1	3	2	2
CO3	3	2	1	2	-	1	2	-	1	1	1	3	2	2
CO4	3	2	1	2	1	1	1	1	1	1	1	3	1	2
CO5	3	1	1	2	1	1	1	1	1	1	1	3	1	2
Average	3.0	2.0	1.2	1.6	1.0	1.0	1.8	1.0	1.0	1.0	1.0	3.0	1.8	2.2

Chairman - BoS
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19CY2151-ENVIRONMENTAL STUDIES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Average	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

19ME2001-ENGINEERING PRACTICES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2
Average	3		3		3				1				1	2

19HE2071-LANGUAGE COMPETENCY ENHANCEMENT COURSE- II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Average	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

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19EE2103 -BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EE2103	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3											3	3
CO2		2											3	0
CO3		1	2	1		2							3	3
CO4									1		1		3	0
CO5			1	1	1								3	0
Average	2.4	2.5	2.0	2	1	3	2	1	-	-	-	1.4	2.6	1.8

19ME2101-ENGINEERING MECHANICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	1	-	-	-	1	-	-	-	1	1	1	2
CO2	3	3	2	1	-	-	1	-	-	-	1	1	1	2
CO3	3	3	1	-	-	1	1	-	-	1	1	-	1	1
CO4	3	3	2	1	-	2	1	-	-	1	1	1	1	1
CO5	3	3	2	1	-	3	1	-	-	1	1	1	1	1
Average	3	3	1.6	1		2	1			1	1	1	1	1.4

19PH2151-MATERIAL SCIENCE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Average	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Chairman - BoS
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19HE1071 -LANGUAGE COMPETENCY ENHANCEMENT COURSE- I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Average	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

19HE2101 - BUSINESS ENGLISH FOR ENGINEERS

19HE2101	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Average	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

19MA2101-DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	2
Average	3	3	3	2.6	2	-	-	-	-	-	-	2	2	2.2

Chairman - BoS
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16CE5202 – DESIGN OF RCC ELEMENTS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	3	1	3	3	1	1	3	3	3
CO2	3	3	3	1	1	1	3	3	3	1	1	3	3	3
CO3	3	3	3	1	1	1	1	3	3	1	1	3	3	3
CO4	3	3	3	3	1	3	3	3	3	1	3	3	3	3
CO5	3	3	3	3	1	3	1	1	3	1	3	3	3	3
Average	3.0	2.8	3.0	2.0	1.0	1.8	1.4	1.8	3.3	1.0	1.4	3.0	3.0	3.0

16CE5203 – DESIGN OF STEEL STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	2	-	1	1	2	2	3	3	3
CO2	3	3	3	2	1	2	-	1	1	2	2	3	3	3
CO3	3	3	3	2	1	2	-	1	1	2	2	3	3	3
CO4	3	3	3	2	1	3	-	1	1	2	2	3	3	3
CO5	3	3	3	2	1	2	-	1	1	2	2	3	3	3
Average	3.0	3.0	3.0	2.0	1.0	2.2	-	1.0	1.0	2.0	2.0	3.0	3.0	3.0

16CE5204 – WATER SUPPLY ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	2	-	2	3	1	2	1	1	3	1	3
CO2	2	1	2	2	1	2	3	-	2	2	1	2	1	2
CO3	2	1	3	2	2	3	3	-	2	2	2	3	2	3
CO4	2	2	3	1	1	3	3	1	2	1	2	3	2	3
CO5	2	2	3	1	3	2	3	1	2	1	2	2	2	3
Average	2.2	1.4	2.8	1.6	1.8	2.4	3.0	1.0	2.0	1.4	1.6	2.6	1.6	2.8

16CE5205 – FOUNDATION ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	3	2	3	2	3	3	3	3
CO2	3	3	3	2	3	-	3	1	1	1	2	3	3	3
CO3	3	3	3	2	-	2	3	2	2	2	1	3	3	3
CO4	3	3	3	3	-	3	3	2	3	2	1	1	3	3
CO5	3	3	3	3	-	3	3	2	2	2	2	3	3	3
Average	3.0	3.0	3.0	2.6	3.0	2.5	3.0	1.8	2.2	1.8	1.8	2.6	3.0	3.0

Chairman - BoS
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Chairman

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HICET

16CE5001 – SOIL MECHANICSLAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	1	2	3	3	1	2	3	3	3
CO2	3	3	2	3	2	1	2	3	3	2	3	3	3	3
CO3	2	3	2	2	2	2	1	3	3	1	2	3	3	3
CO4	3	3	2	2	2	1	1	3	3	2	2	3	3	3
CO5	3	3	2	3	2	2	1	3	3	1	2	3	3	3
Average	**2.8**	**3.0**	**2.2**	**2.4**	**2.0**	**1.4**	**1.4**	**3.0**	**3.0**	**1.4**	**2.2**	**3.0**	**3.0**	**3.0**

16CE5002 – CONCRETE AND HIGHWAY ENGINEERING LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1.5	2	3	2	1	2	1	3	2	1
CO2	3	3	2	3	1.5	2	3	2	1	1	1	3	2	1
CO3	3	3	2	3	1.5	1	3	2	2	1	1	3	2	1
CO4	3	3	2	3	1.5	1	3	1	1	1	1	3	2	1
CO5	3	3	2	3	1.5	1	3	1	1	1	1	3	2	1
Average	**3.0**	**3.0**	**2.0**	**3.0**	**1.5**	**1.4**	**3.0**	**1.6**	**1.2**	**1.2**	**1.0**	**3.0**	**2.0**	**1.0**

16CE5003 – SURVEY CAMP

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1	1	-	1	3	3	2	1	2	2
CO2	2	2	1	2	1	1	-	1	3	3	2	1	2	2
CO3	2	2	1	2	1	1	-	1	3	3	2	1	2	2
CO4	2	2	1	2	1	1	-	1	3	3	2	1	2	2
CO5	2	2	1	2	1	1	-	1	3	3	2	1	2	2
Average	**2.0**	**2.0**	**1.0**	**2.0**	**1.0**	**1.0**	**-**	**1.0**	**3.0**	**3.0**	**2.0**	**1.0**	**2.0**	**2.0**

16CE6201 – STRUCTUR ALANALYSIS –II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO2	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO3	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO4	3	3	1	2	1	2	-	-	-	-	1	3	3	3
CO5	3	3	1	2	1	2	-	-	-	-	1	3	3	3
Average	**3.0**	**3.0**	**1.0**	**2.0**	**1.0**	**2.0**	**-**	**-**	**-**	**-**	**1.0**	**3.0**	**3.0**	**3.0**

Chairman - BoS
CIVIL - HiCET

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HiCET

16CE6202 – DESIGNOF RCC STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	2	-	1	1	2	2	3	3	3
CO2	3	3	3	2	1	3	-	1	1	2	2	3	3	3
CO3	3	3	3	2	1	3	-	1	1	2	2	3	3	3
CO4	3	3	3	2	1	2	-	1	1	2	2	3	3	3
CO5	3	3	3	2	1		-	1	1	2	2	3	3	3
Average	**3.0**	**3.0**	**3.0**	**2.0**	**1.0**	**2.5**	**-**	**1.0**	**1.0**	**2.0**	**2.0**	**3.0**	**3.0**	**3.0**

16CE6203 –HYDROLOGY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	2	-	-	-	-	2	1	1
CO2	3	2	1	1	1	1	2	-	-	2	-	2	1	2
CO3	3	2	1	1	1	1	2	-	-	2	-	2	1	2
CO4	3	2	1	1	1	1	2	-	-	2	-	2	1	2
CO5	3	1	1	1	1	1	1	-	-	2	-	2	1	2
Average	**2.8**	**1.6**	**1.0**	**1.0**	**1.0**	**1.0**	**1.8**	**-**	**-**	**2.0**	**-**	**2.0**	**1.0**	**1.8**

16CE6204 – WASTE WATER ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	2	-	2	3	2	2	-	3	3	1	3
CO2	2	1	2	2	-	2	3	-	2	2	3	2	1	2
CO3	2	1	3	2	2	3	3	2	2	2	2	3	2	3
CO4	2	2	3	1	-	3	3	1	2	-	2	3	2	3
CO5	2	2	3	1	3	2	3	1	2	-		2	2	3
Average	**2.2**	**1.4**	**2.8**	**1.6**	**2.5**	**2.4**	**3.0**	**1.5**	**2.0**	**2.0**	**2.5**	**2.6**	**1.6**	**2.8**

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

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HiCET

16CE6001 – ENVIRONMENTAL ENGINEERING LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	1	-	2	3	-	2	2	1	2	1	3
CO2	3	2	3	2	1	2	2	1	1	2	1	2	1	3
CO3	3	3	3	3	2	3	3	1	1	1	2	2	2	3
CO4	3	3	3	3	3	3	3	2	2	2	2	3	2	3
CO5	3	1	3	3	2	3	3	2	2	2	1	3	2	3
Average	**3.0**	**2.0**	**3.0**	**2.4**	**2.0**	**2.6**	**2.8**	**1.5**	**1.6**	**1.8**	**1.4**	**2.4**	**1.6**	**3.0**

16CE6002 – DESIGN AND DRAWING –I (RCC&STEEL)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	-	2	1	3	3	3	3	3
CO2	3	3	3	2	3	3	-	2	1	3	3	3	3	3
CO3	3	3	2	2	3	2	-	2	1	2	3	3	3	3
CO4	3	3	3	2	3	3	-	2	1	2	3	3	3	3
CO5	3	3	3	2	3	3	-	2	1		3	3	3	3
Average	**3.0**	**3.0**	**2.8**	**2.0**	**3.0**	**2.8**	-	**2.0**	**1.0**	**2.5**	**3.0**	**3.0**	**3.0**	**3.0**

16CE7201 - ESTIMATION, COSTING AND VALUATION ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	1	1	1	2	1	3	3	3	3	3
CO2	3	2	1	1	1	1	1	2	1	2	2	3	3	3
CO3	3	2	1	1	-	1	1	2	1	2	1	3	3	3
CO4	3	3	3	3	1	2	1	3	-	2	2	3	3	3
CO5	3	1	1	-	1	1	1	2	1	3	1	3	3	3
Average	3.0	2.0	1.5	1.8	1.0	1.2	1.0	2.2	1.0	2.4	1.8	3.0	3.0	3.0

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL Chairman

Dean (Academics)
HiCET

16CE7202 - CONCRETE TECHNOLOGY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	2	2	1	1	1	1	3	3	3
CO2	3	3	3	3	-	2	2	1	-	1	1	3	3	3
CO3	3	3	2	2	1	2	2	1	1	1	1	3	3	3
CO4	3	-	2	2	-	3	2	1	-	1	1	3	3	3
CO5	3	3	2	-	-	2	2	-	1	1	2	3	3	3
Average	3.0	3.0	2.2	2.3	1.0	2.2	2.0	1.0	1.0	1.0	1.2	3.0	3.0	3.0

16CE7203 - IRRIGATION AND HYDRAULIC STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	2	2	2	1	2	2	3	2
CO2	3	3	3	3	-	3	2	3	-	2	3	1	3	2
CO3	3	2	2	2	1	3	3	2	-	2	2	2	3	2
CO4	3	2	2	2	-	2	3	2	1	2	3	1	3	2
CO5	3	2	2	3	-			3	1	2		1	3	2
Average	3.0	2.0	2.2	2.4	1.0	2.5	2.5	2.4	1.3	1.8	2.5	1.4	3.0	2.0

16CE7001 - DESIGN AND DRAWING –II(IRRIGATION & ENVIRONMENTAL ENGINEERING)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	3	3	2	3	2	2	1	3	2
CO2	3	3	2	2	2	3	3	2	3	2	3	1	3	2
CO3	3	3	3	3	2	3	3	3	3	3	3	1	3	2
CO4	3	3	3	3	2	3	3	3	3	3	3	1	3	2
CO5	3	3	3	3	2	3	3	3	3	3	3	1	3	2
Average	3.0	3.0	2.6	2.6	2.0	3.0	3.0	2.6	3.0	2.6	2.8	1.0	3.0	2.0

Chairman - BoS
CIVIL - HICET

ACADEMIC COUNCIL * Chairman * KARPAGAM COLLEGE OF ENGG & TECH

Dean (Academics)
HICET

16CE7002 - DESIGN PROJECT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

16CE8201 - STRUCTURALDYNAMICSANDEARTHQUAKEENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	1	1		1	2	3	3	1
CO2	3	3	3	3	1	1	1	1		1	2	3	3	1
CO3	3	1	1	-	1	1	1	1		1	2	3	3	1
CO4	3	3	3	3	1	1	1	1		1	2	3	2	1
CO5	3	3	3	3	1	2	1	1		1	2	3	2	1
Average	3.0	2.6	2.6	2.8	1.0	1.3	1.0	1.0	-	1.0	2.0	3.0	2.6	1.0

16CE8901 – PROJECTWORK

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

16CE5301 –ADVANCED SURVEYING TECHNIQUES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	3		2	2	2	1	2	3	3
CO2	3	3	2	2	3	3		2	2	2	1	2	3	3
CO3	3	3	3	2	1	3		2	2	2	1	2	3	3
CO4	3	3	2	3	3	3		2	2	1	1	2	3	3
CO5	3	3	2	3	3	3		2	2	1	1	2	3	3
Average	**3**	**3**	**2.2**	**2.4**	**2.6**	**3**	**-**	**2**	**2**	**1.6**	**1**	**2**	**3**	**3**

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL
KINGS COLLEGE OF ENGG & TECH
Chairman

Dean (Academics)
HiCET

16CE5302 – REMOTE SENSING AND GIS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			1	2	1		1		2			3	3
CO2	3			2	3	2		2		2			3	3
CO3	3			2	3	2		2		3			3	3
CO4	3			1	3	2		2		2			3	3
CO5	3			2	3	1		1		2			3	3
Average	**3**			**1.6**	**2.8**	**1.6**		**1.6**		**2.2**			**3**	**3**

16CE5303 –BRIDGE ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	1	3	3	2	1	2	3	3
CO2	3	1	2	1	1	3	1	3	1	2	1	2	3	3
CO3	3	3	3	3	3	3	1	3	2	2	1	2	3	3
CO4	3	2	2	2	1	3	1	3	1	2	1	2	3	3
CO5	3	2	3	3	1	3	1	3	1	2	1	2	3	3
Average	**3**	**2.5**	**3**	**3**	**2**	**3**	**1**	**3**	**2**	**2**	**1**	**2**	**3**	**3**

16CE5304 – CONSTRUCTION PLANNING AND SCHEDULING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1									3	2	2	2
CO2	3	2	2	2	3	2		2	2		3	2	2	2
CO3	3	2		2	2	2		2	2		3	2	2	2
CO4	3	3	3	2		2		2	2		3	2	2	2
CO5	3	2	3					1	2	2	3	2	2	1
Average	**3**	**2**	**2.6**	**2**	**2.5**	**2**	**-**	**1.7**	**2**	**2**	**3**	**2**	**2**	**1.8**

16CE5305 - AIRPORTS, DOCKS AND HARBOUR ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	3		2	2			1	1	3	3
CO2	3	1	1	1	2	3	2	1	1		1		3	3
CO3	3	3	2	1	2		2	2				1	3	3
CO4	3	1	3	1	2	3	2	1	1		1		3	3
CO5	3	3	1	2	1	2	2	1	1		1	1	3	3
Average	**3**	**2.5**	**1.5**	**1.5**	**2**	**2**	**2**	**1.5**	**1**		**1**	**1**	**3**	**3**

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

16CE6301 – ARCHITECTURE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3			2	2	2			2	2	3	2
CO2	3	2	3	1		3	3	3			2	3	3	3
CO3	3	2	3	1		3	3	3		2	2	3	3	3
CO4	3	2	3	1		3	3	3			2	2	3	3
CO5	3	2	2	1		3	3	3			2	2	3	3
Average	3	1.8	2	1	-	2.8	2.8	2.8	-	2	2	2.4	3	2.8

16CE6302 – INTERIOR DESIGN

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1				2	2					2	1
CO2	2		2	2			1						2	2
CO3	2		2				2	2	2				2	2
CO4	2		1	2			2						2	2
CO5	2		2				1	3					2	1
Average	2		1.6	2			1.6	2.3	2				2	1.6

16CE6303 – URBANPLANNING AND DEVELOPMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			2	3						1	
CO2	3		2			2	2		2	3	2		2	2
CO3	3	3	3	3		2	2	2	2	3	2	2	2	2
CO4	3		2	2		2	2					2	2	2
CO5	3	3	2	2		2		3	2	3	3		2	
Average	3	3	2.2	2.3	-	2	2.2	2.5	2	3	2.3	2	1.8	2

16CE6304 – HOUSING PLANNING AND MANAGEMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			2	3						1	
CO2	3		2			2	2		2	3	2		2	2
CO3	3	3	3	3		2	2	2	2	3	2	2	2	2
CO4	3		2	2		2	2					2	2	2

Chairman - BoS
CIVIL - HICET

ACADEMIC COUNCIL
Chairman
KSR INSTITUTION COLLEGE

Dean (Academics)
HICET

CO5	3	3	2	2		2		3	2	3	3		2	
Average	3	3	2.2	2.3	-	2	2.2	2.5	2	3	2.3	2	1.8	2

16CE6305 – ENGINEERING ECONOMICS AND COST ANALYSIS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		2		2		1		2	3	3	3
CO2	3	2	2		1	2	3	2	2	1	2	2	3	2
CO3	3	3	3		2	3	2		1	1	3	2	3	2
CO4	3	3	2	2	2	3	2	2	1		2	3	2	3
CO5	3	3	2		2	3	3					2	3	3
Average	3	2.8	2.4	2	1.8	2.75	2.4	2	1.25	1	2.25	2.4	2.8	2.6

16CE7301 - AIR POLLUTION MANAGEMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1		2	2					1	2	2
CO2	2	2	1			1	2						2	2
CO3	2	2	2		1	1	2						2	2
CO4	2	2	2			1	2	1					2	2
CO5	2	2	2			1	2	1					2	2
Average	2	2	1.6	1	1	1.2	2	1				1	2	2

16CE7303 - MUNICIPAL SOLID WASTE MANAGEMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2		2	3			3	2	2	3	2
CO2	3	3	2	2		3	3	2	2	2	3	2	3	3
CO3	3	2	2	1		3	2	3	3		3	3	2	3
CO4	3	3	3	2		3	3	2	2	2	2	3	3	3
CO5	3	2			2	3	3		3	3	3	2	3	2
Average	3	2	2.3	2	2	2.5	3	2.3	3	3	2.5	2	3	2

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

16CE7304 - HAZARDOUS WASTE MANAGEMENT AND SITE REMEDIATION

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	-	3	2	-	2	3	3	3	3	3
CO2	3	3	2	-	3	2	3	2	2	-	2	3	3	3
CO3	3	2	-	1	-	2	3	1	-	3	3	2	3	3
CO4	3	3	2	-	-	3	2	1	-	-	2	3	3	3
CO5	3	2	-	-	-	3	3	-	2	2	2	3	3	3
Average	3	2.6	2	1	3	2.6	2.6	1.3	2	2.6	2.4	2.8	3	3

16CE7305 - INDUSTRIAL WASTEWATER ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	-	3	2	-	2	3	3	3	3	3
CO2	3	3	2	-	3	2	3	2	2	-	2	3	3	3
CO3	3	2	-	1	-	2	3	1	-	3	3	2	3	3
CO4	3	3	2	-	-	3	2	1	-	-	2	3	3	3
CO5	3	2	-	-	-	3	3	-	2	2	2	3	3	3
Average	3	2.6	2	1	3	2.6	2.6	1.3	2	2.6	2.4	2.8	3	3

16CE8301 - COMPUTER AIDED DESIGN OF STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3	3		1				2	3	1
CO2	3	3	3		3	2		1				2	3	1
CO3	3	3	3		3	3		3		3		3	3	1
CO4	3	3	3		3	3		3	3	3		2	3	1
CO5	3	3	3		3	3		3	3	3		2	3	1
Average	3	3	3		3	3		2	3	3		2	3	1

16CE8202 - DESIGN OF INDUSTRIAL STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO2	3	3	3	1	-	-	-	2	2	-	-	2	3	2

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL * HICET * Chairman

Dean (Academics)
HiCET

16CE7304 - HAZARDOUS WASTE MANAGEMENT AND SITE REMEDIATION

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	-	3	2	-	2	3	3	3	3	3
CO2	3	3	2	-	3	2	3	2	2	-	2	3	3	3
CO3	3	2	-	1	-	2	3	1	-	3	3	2	3	3
CO4	3	3	2	-	-	3	2	1	-	-	2	3	3	3
CO5	3	2	-	-	-	3	3	-	2	2	2	3	3	3
Average	3	2.6	2	1	3	2.6	2.6	1.3	2	2.6	2.4	2.8	3	3

16CE7305 - INDUSTRIAL WASTEWATER ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	-	3	2	-	2	3	3	3	3	3
CO2	3	3	2	-	3	2	3	2	2	-	2	3	3	3
CO3	3	2	-	1	-	2	3	1	-	3	3	2	3	3
CO4	3	3	2	-	-	3	2	1	-	-	2	3	3	3
CO5	3	2	-	-	-	3	3	-	2	2	2	3	3	3
Average	3	2.6	2	1	3	2.6	2.6	1.3	2	2.6	2.4	2.8	3	3

16CE8301 - COMPUTER AIDED DESIGN OF STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3	3		1				2	3	1
CO2	3	3	3		3	2		1				2	3	1
CO3	3	3	3		3	3		3		3		3	3	1
CO4	3	3	3		3	3		3	3	3		2	3	1
CO5	3	3	3		3	3		3	3	3		2	3	1
Average	3	3	3		3	3		2	3	3		2	3	1

16CE8202 - DESIGN OF INDUSTRIAL STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO2	3	3	3	1	-	-	-	2	2	-	-	2	3	2

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL Chairman

Dean (Academics)
HiCET

CO3	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO4	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO5	3	3	3	1	-	-	-	2	2	-	-	2	3	2
Average	3	3	3	1	-	-	-	2	2	-	-	2	3	2

16CE8303 - DESIGN OF PRESTRESSED CONCRETE STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO2	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO3	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO4	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO5	3	3	3	1	-	-	-	2	2	-	-	2	3	2
Average	3	3	3	1	-	-	-	2	2	-	-	2	3	2

16CE8304 - REPAIR AND REHABILITATION OF STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3			1	1	2			1	3	3
CO2	3	2	3	2			1	1	1			1	3	3
CO3	3	2	3	2			1	1	1			1	3	3
CO4	2	2	3	2			1	1	1			1	3	3
CO5	2	2	3	2			1	1	1			1	3	3
Average	2.6	2	3	2.2	-	-	1	1	1.2	-	-	1	3	3

16CE8305 - VALUATION OF LAND AND BUILDINGS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	3	2	3	2	2	2	3	3
CO2	3	3	2	3	2	2	3	1	1	2	2	2	0	0
CO3	3	2	2	2	3	2	1	3	2	3	3	1	3	3
CO4	3	3	2	2	2	3	2	2	2	3	2	3	3	0
CO5	3	2	2	2	1	0	3	1	3	2	2	3	3	3
Average	3	2.6	2.2	2.4	2	2	2.4	1.8	2.2	2.4	2.2	2.2	2.4	1.8

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL
Chairman
KUMARAGURU COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

16CE8306 - GROUNDWATER ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1			3		3	2		2	3	3
CO2	3	3	3	2		1	2		2	2		1	3	3
CO3	3	2	3	3		2	1		2	1		3	3	3
CO4	3	3	3	3		2	2		3	2		3	3	3
CO5	3	2	3	3		1	3		2	2		2	3	3
Average	3	2.5	3	2.75	-	1.5	2	-	2.25	1.75	-	2.25	3	3

16CE8307 - INTEGRATED WATER RESOURCES MANAGEMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	-	3	2	-	2	3	3	3	3	3
CO2	3	3	2	-	3	2	3	2	2	-	2	3	3	3
CO3	3	2	-	1	-	2	3	1	-	3	3	2	3	3
CO4	3	3	2	-	-	3	2	1	-	-	2	3	3	3
CO5	3	2	-	-	-	3	3	-	2	2	2	3	3	3
Average	3	2.6	2	1	3	2.6	2.6	1.3	2	2.6	2.4	2.8	3	3

16CE8308 - ROCK ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1			2	2	3	3	3	3	3	3	3
CO2	3		2			1	2		3	2	2	3	3	3
CO3	3	1	2	1		2			2	2	3	3	3	3
CO4	3	3				2		3	2	2	2	3	3	3
CO5	3	3	2	1		2			2	1	2	3	3	3
Average	3	3	1.5	1		2	2	3	2.5	2	2.5	3	3	3

16CE8309 - GROUND IMPROVEMENT TECHNIQUES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1			3		3	2		2	3	3
CO2	3	3	3	2		1	2		2	2		1	3	3

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL
Chairman
KINGS INDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

CO3	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO4	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO5	3	3	3	1	-	-	-	2	2	-	-	2	3	2
Average	3	3	3	1	-	-	-	2	2	-	-	2	3	2

16CE8303 - DESIGN OF PRESTRESSED CONCRETE STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO2	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO3	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO4	3	3	3	1	-	-	-	2	2	-	-	2	3	2
CO5	3	3	3	1	-	-	-	2	2	-	-	2	3	2
Average	3	3	3	1	-	-	-	2	2	-	-	2	3	2

16CE8304 - REPAIR AND REHABILITATION OF STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3			1	1	2			1	3	3
CO2	3	2	3	2			1	1	1			1	3	3
CO3	3	2	3	2			1	1	1			1	3	3
CO4	2	2	3	2			1	1	1			1	3	3
CO5	2	2	3	2			1	1	1			1	3	3
Average	2.6	2	3	2.2	-	-	1	1	1.2	-	-	1	3	3

16CE8305 - VALUATION OF LAND AND BUILDINGS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	3	2	3	2	2	2	3	3
CO2	3	3	2	3	2	2	3	1	1	2	2	2	0	0
CO3	3	2	2	2	3	2	1	3	2	3	3	1	3	3
CO4	3	3	2	2	2	3	2	2	2	3	2	3	3	0
CO5	3	2	2	2	1	0	3	1	3	2	2	3	3	3
Average	3	2.6	2.2	2.4	2	2	2.4	1.8	2.2	2.4	2.2	2.2	2.4	1.8

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

CO3	3	2	3	3		2	1		2	1		3	3	3
CO4	3	3	3	3		2	2	1	3	2	1	3	3	3
CO5	3	2	3	3		1	3		2	2	1	2	3	3
Average	3	2	3	2		1	3		2.5	2	1	2	3	3

16CE8310 - EARTH RETAINING STRUCTURES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1			2	2	3	3	3	3	3	3	3
CO2	3		2			1	2		3	2	2	3	3	3
CO3	3	1	2	1		2			2	2	3	3	3	3
CO4	3	3				2		3	2	2	2	3	3	3
CO5	3	3	2	1		2			2	1	2	3	3	3
Average	3	3	1.5	1		2	2	3	2.5	2	2.5	3	3	3

16CE6401 – BUILDING SERVICES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1		2		2	2	2		2	2	1
CO2	2	2		1		1			1			1	2	1
CO3	2		1			2		1	2			2	2	1
CO4	2		1			2		2	2			2	2	1
CO5	2		1			2		1	2			2	2	1
Average	2	2	1	1		2		1.5	2	2		2	2	1

16CE7402 - STRATEGIES OF GREEN BUILDINGS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2			1	2	3	2		2	3	3
CO2	3	3	3	2	2		1	2	2	2	1	2	3	3
CO3	3	3	3	2	2		1	2	2	2	1	2	3	3
CO4	3	3	3	2	2		1	2	2	2	1	2	3	3
CO5		2		2		2	1	2	2	2	1	2	3	3
Average	3	2.5	3	2	2	2	1	2	2.5	2	1	2	3	3

Chairman - BoS
CIVIL - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE * Chairman

Dean (Academics)
HiCET