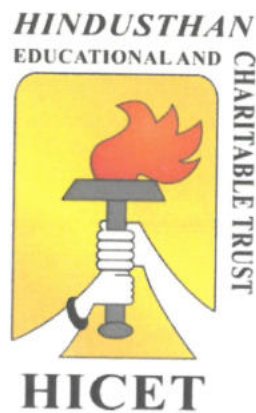


HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(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



Curriculum & Syllabus

2021-2022

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

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
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	21HE1101	Technical English	HSC	2	1	0	3	40	60	100
2	21MA1102	Calculus and Linear Algebra	BSC	3	1	0	4	40	60	100
THEORY WITH PRACTICAL COMPONENT										
3	21PH1151	Applied Physics	BSC	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BSC	2	0	2	3	50	50	100
5	21CS1151	Problem Solving Python Programming	ESC	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ESC	1	0	4	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course - I	HSC	1	0	0	1	100	-	100
MANDATORY COURSE										
8	21MC1191	Induction Programme	MC	-	-	-	-	-	-	-
9	21HE1072	Career Guidance Level - I Personality, Aptitude and Career Development	MC	2	0	0	0	100	100	100
10	21HE1073	Entrepreneurship and Innovation	MC	1	0	0	0	100	100	100
Total				16	2	10	20	580	320	900

SEMESTER II

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HSC	2	1	0	3	40	60	100
2	21MA2101	Differential Equations and Complex Variables	BSC	3	1	0	4	40	60	100
3	21EE2103	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	40	60	100
4	21ME2101	Engineering Mechanics	ESC	3	0	0	3	40	60	100
THEORY WITH PRACTICAL COMPONENT										
5	21PH2151	Material Science	BSC	2	0	2	3	50	50	100
6	21CY2151	Environmental Studies	BSC	2	0	2	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices	ESC	0	0	4	2	50	50	100
8	21HE2071	Language Competency Enhancement Course -II	HSC	1	0	0	1	100	-	100
MANDATORY COURSE										
9	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	MC	2	0	0	0	100		100
Total				18	2	8	22	510	390	900

SEMESTER III

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3103	Fourier Analysis and Numerical Methods	BSC	3	1	0	4	25	75	100
2	19CE3201	Mechanics of Fluids	PCC	3	0	0	3	25	75	100
3	19CE3202	Geology and Construction Materials	PCC	3	0	0	3	25	75	100
4	19CE3203	Surveying	PCC	3	0	0	3	25	75	100
THEORY WITH PRACTICAL COMPONENT										
5	19CE3251	Mechanics of Solids	PCC	2	0	2	3	50	50	100
PRACTICAL										
6	19CE3001	Survey Lab	PCC	0	0	4	2	50	50	100
7	19CE3002	Computer Aided Building Drawing	PCC	0	0	4	2	50	50	100
MANDATORY COURSE										
8	19MC3191	Indian Constitution	MC	2	0	0	0	-	-	-
Total				16	1	10	20	250	450	700

SEMESTER IV

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA4103	Probability and Statistics	BSC	3	1	0	4	25	75	100
2	19CE4201	Strength of Materials	PCC	3	1	0	4	25	75	100
3	19CE4202	Applied Hydraulics and Hydraulic Machinery	PCC	3	0	0	3	25	75	100
4	19CE4203	Soil Mechanics	PCC	3	0	0	3	25	75	100
THEORY WITH PRACTICAL COMPONENT										
5	19CE4251	Concrete Technology	PCC	2	0	2	3	50	50	100
PRACTICAL										
6	19CE4001	Soil Mechanics Lab	PCC	0	0	4	2	50	50	100
7	19CE4002	Fluid Mechanics and Hydraulic Machinery Lab	PCC	0	0	4	2	50	50	100
MANDATORY COURSE										
8	19MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	-	-	-
Total				16	2	10	21	250	450	700

SEMESTER V

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CE5201	Structural Analysis - I	PCC	3	0	0	3	25	75	100
2	19CE5202	Design of RC Elements	PCC	3	1	0	4	25	75	100
3	19CE5203	Water Supply Engineering	PCC	3	0	0	3	25	75	100
4	19CE5204	Foundation Engineering	PCC	3	0	0	3	25	75	100
5	19CE5205	Highway and Railway Engineering	PCC	3	0	0	3	25	75	100
6	19CE53XX	Professional Elective - I	PEC	3	0	0	3	25	75	100
PRACTICAL										
7	19CE5001	Concrete and Highway Engineering Lab	PCC	0	0	4	2	50	50	100
8	19CE5002	Survey Camp*	PCC	0	0	0	1	50	50	100
MANDATORY COURSE										
9	19HE5071	Soft Skills - I	MC	1	0	0	1	100		100
10	19HE5072	Design Thinking	MC	1	0	0	1	100		100
Total				20	1	4	24	450	550	1000

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

SEMESTER VI

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CE6201	Structural Analysis - II	PCC	3	0	0	3	25	75	100
2	19CE6202	Design of Steel Structural Elements	PCC	3	0	0	3	25	75	100
3	19CE6203	Wastewater Engineering	PCC	3	0	0	3	25	75	100
4	19CE6204	Construction Management	PCC	3	0	0	3	25	75	100
5	19CE63XX	Professional Elective - II	PEC	3	0	0	3	25	75	100
6	19XX64XX	Open Elective - I	OEC	3	0	0	3	25	75	100
PRACTICAL										
7	19CE6001	Water and Wastewater Testing Lab	PCC	0	0	3	1.5	50	50	100
8	19CE6002	Design and Drawing of RC Structures	PCC	0	0	3	1.5	50	50	100
9	19CE6701	Internship / Industrial Training*	EEC	0	0	0	1	0	100	100
MANDATORY COURSE										
10	19HE6071	Soft Skills – II	MC	1	0	0	1	100		100
11	19HE6072	Intellectual Property Rights	MC	1	0	0	1	100		100
Total				20	0	6	24	450	650	1100

*Internship / Industrial Training of three weeks duration has to be undergone by the students from third to fifth semester vacation

PROFESSIONAL ELECTIVE – III

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

PROFESSIONAL ELECTIVE – IV

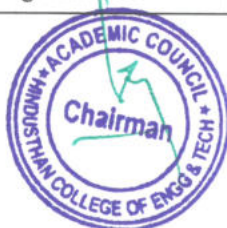
S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16CE7306	Design of Masonry and Timber Structures	3	-	-	3	25	75	100
2	16CE7307	Disaster Resistant Structures	3	-	-	3	25	75	100
3	16CE7308	Tall Buildings	3	-	-	3	25	75	100
4	16CE7309	Finite Element Techniques	3	-	-	3	25	75	100
5	16CE7310	Prefabricated Structures	3	-	-	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	-	-	3	25	75	100
2	16CE8302	Design of Industrial Structures	3	-	-	3	25	75	100
3	16CE8303	Design of Prestressed Concrete Structures	3	-	-	3	25	75	100
4	16CE8304	Repair and Rehabilitation of Structures	3	-	-	3	25	75	100
5	16CE8305	Valuation of Land and Buildings	3	-	-	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	-	-	3	25	75	100
2	16CE8307	Integrated Water Resources Management	3	-	-	3	25	75	100
3	16CE8308	Rock Engineering	3	-	-	3	25	75	100
4	16CE8309	Ground Improvement Techniques	3	-	-	3	25	75	100
5	16CE8310	Earth Retaining Structures	3	-	-	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

R2016

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

R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165


Chairman, Board of Studies
**Chairman - BOS
CIVIL - HICET**


Dean - Academics
**Dean (Academics)
HICET**




Principal
PRINCIPAL
Hindusthan College of Engineering & Technology,
COIMBATORE - 641 032



SYLLABUS



Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	2	1	0	3

- Course Objective**
1. To facilitate students to communicate effectively with coherence.
 2. To train the learners in descriptive communication.
 3. To introduce professional communication.
 4. To enhance knowledge and to provide the information on corporate environment.
 5. To equip the trainers with the necessary skills on critical thinking.

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 and Vocabulary -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 announcements Reading - Reading about technical inventions, research and development Writing - Letter inviting a candidate for interview, Job application and resume preparation Grammar and Vocabulary - Homophones and Homonyms.	9
IV	Listening and Speaking —Practicetelephoneskillsand telephoneetiquette(listeningandresponding, askingquestions). 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 inGDs 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-Trainedtomaintaincoherenceandcommunicateeffectively.
 - 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-Taughttoimprove interpersonal and intrapersonal lskills.

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- KamaleshSadanana “A Foundation Course for the Speakers of Tamil-Part-I &II”, Orient Blackswan,2010.

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HICET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21MA1102	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 parelloiped.	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 parelloiped.	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

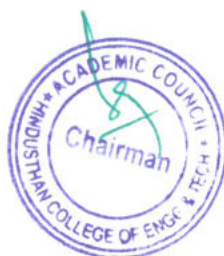
- Course Outcome**
- CO1: Apply the concept of differentiation in any curve
CO2: Identify the maximum and minimum values of surfaces
CO3: Apply double integrals to compute area of plane curves
CO4: Evaluation of triple integrals to compute volume of solids
CO5: Calculate Eigen values and Eigen vectors 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.	21PH1151	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
PROPERTIES OF MATTER		
I	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.	6+3(P)
Determination of Young's modulus by uniform bending method		
OSCILLATIONS		
II	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.	6+3(P)
Determination of Rigidity modulus – Torsion pendulum		
WAVE OPTICS		
III	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.	6+6(P)
Determination of wavelength of mercury spectrum – spectrometer grating Determination of thickness of a thin wire – Air wedge method		
LASER AND APPLICATIONS		
IV	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.	6+3(P)
Determination of Wavelength and particle size using Laser		
FIBER OPTICS AND APPLICATIONS		
V	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

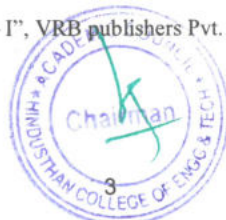
TEXT BOOKS:

- 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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HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CY1151	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

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.

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HICET*

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.	21CS1151	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
I	ALGORITHMIC PROBLEM SOLVING 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
II	DATA, EXPRESSIONS, STATEMENTS 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)
III	CONTROL FLOW, FUNCTIONS Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, 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)
IV	LISTS, TUPLES, DICTIONARIES 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)
V	FILES, MODULES, PACKAGES 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 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.	21ME1152	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", Dhanlaxmi 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.	21HE1071	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.
R4 - Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.

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Course code
21HE1072

Course title
CAREER GUIDANCE LEVEL I
Personality, Aptitude and Career Development
None

L T P C
2 0 0 0

Pre-requisite

Syllabus version
1

Course Objectives:

- Introduce students to building blocks of Logical reasoning and Quantitative Aptitude [SLO 1]
- Train students on essential grammar for placements [SLO 2]
- Introduce students on scientific techniques to pick up skills [SLO 3]
- Provide an orientation for recruiter expectation in terms of non-verbal skills, and for how to build one's career with placements in mind [SLO 4]

Expected Course Outcome:

Enable students to approach learning Aptitude with ease, and understand recruiter expectation.

Student Learning Outcomes (SLO): 1, 2, 3 and 4

Module:1 Lessons on excellence 1 hour SLO: 3
Skill introspection, Skill acquisition, consistent practice

Module:2 Logical Reasoning 7 hours SLO: 1
Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail

Picture and word driven Qs to develop attention to detail as a skill

Module:3 Quantitative Aptitude 8 hours SLO: 1
Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques

- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Module:4 Recruitment Essentials 1 hour SLO: 4
Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?


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Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

Module:5 Verbal Ability

3 hours

SLO: 2

Essential grammar for placements:

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

Verbal Reasoning

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE1073	ENTREPRENEURSHIP AND INNOVATION	1	0	0	0

Course Objective
1. To acquire the knowledge and skills needed to manage the development of innovation
2. To recognize and evaluate potential opportunities to monetize these innovations
3. To plan specific and detailed method to exploit these opportunities
4. To acquire the resources necessary to implement these plans
5. To make students understand organizational performance and its importance

Module	Description	Instructional Hours
1	Entrepreneurial Thinking	
2	Innovation Management	
3	Design Thinking	
4	Opportunity Spotting / Opportunity Evaluation	
5	Industry and Market Research	
6	Innovation Strategy and Business Models	
7	Financial Forecasting	
8	Business Plans/ Business Model Canvas	
9	Entrepreneurial Finance	
10	Pitching to Resources Providers / Pitch Deck	
11	Negotiating Deals	
12	New Venture Creation	
13	Lean Start-ups	
14	Entrepreneurial Ecosystem	
15	Velocity Venture	
Total Instructional Hours		15

Course Outcome
CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects
CO2: Understand the processes by which innovation is fostered, managed, and commercialized
CO3: Remember effectively and efficiently the potential of new business opportunities
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness
CO5: Develop a business model for a new venture, including revenue. Margins, operations, working capital, and investment

TEXT BOOKS:

- T1- Arya Kumar "Entrepreneurship – Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012)
T2- Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition(2016).

REFERENCE BOOKS:

- R1- Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007)
R2-Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017)
R3 - Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

WEB RESOURCES

- W1: <https://blof.forgeforward.in/tagged/startup-lessons>
W2: <https://blof.forgeforward.in/tagged/entrepreneurship>
W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>
W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>
W5: <https://blof.forgeforward.in/tagged/innovation>
W6: <https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwlwn7fdnXe6Lw>

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE2101	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.	21MA2101	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 separable 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.	21EE2103	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

Course Objective	Description
	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	Description
	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.	21ME2101	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.	21PH2151	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 (Meissner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High T _c 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" V.K.B. publishers Pvt Ltd., 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21CY2151	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)
	HUMAN POPULATION AND THE ENVIRONMENT	
V	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.	6+3(P)
	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

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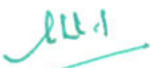
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TEXT BOOKS:

- 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.	21ME2001	ENGINEERING PRACTICES	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 1 1/2 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, planing 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.	21HE2071	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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Course code	Course title	L	T	P	C
21HE2072	CAREER GUIDANCE LEVEL II	2	0	0	0
Pre-requisite	Personality, Aptitude and Career Development None				Syllabus version 1

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]

Expected Course Outcome:

Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

Student Learning Outcomes (SLO): 6, 7, 8

Module:1 Logical Reasoning 5 hours SLO: 6

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2 Quantitative Aptitude 8 hours SLO: 7

Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3 Verbal Ability 7 hours SLO: 8

Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

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- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

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SYLLABUS



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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA3103	FOURIER ANALYSIS AND NUMERICAL METHODS	3	1	0	4

- 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. Apply Fourier transform techniques used in wide variety of situations
 4. Apply various methods to solve numerical differentiation and numerical integration
 5. Explain 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
FOURIER SERIES		
I	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.	12
BOUNDARY VALUE PROBLEMS		
II	Classification – solution of one dimensional wave equation – one dimensional heat equation – Fourier series solution in Cartesian coordinates.	12
FOURIER TRANSFORMS		
III	Fourier Transform Pair - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem – Parseval's identity.	12
INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION		
IV	Interpolation: Newton's forward and backward difference formulae – Newton's divided difference formula and Lagrangian interpolation for unequal intervals. Differentiation: Newton's forward and backward interpolation formulae for equal intervals – Newton's divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson's 1/3 and 3/8 rules.	12
INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS		
V	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.	12
Total Instructional Hours		60

- Course Outcome**
- CO1: Understand the function in terms of sine and cosine terms in fourier series and also to get knowledge in fourier transforms
- CO2: Demonstrate the 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: Understand and apply the concepts of interpolation, numerical differentiation and integration
- CO5: Understand the concept of solving ordinary differential equations using single and multi step methods

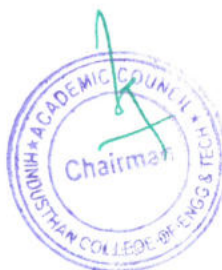
TEXT BOOKS:

- T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018
- T2 - Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2012.

REFERENCE BOOKS :

- R1 - Kreyszig E. "Advanced Engineering Mathematics", Eight Edition, John Wiley & sons (Asia) Ltd 2010.
- R2 - Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
- R3- Gupta S.K., "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.	19CE3201	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-Poiseuille equation – Turbulent flow - Major and minor losses of flow in pipes - Darcy Weisbach's equation - Moody's diagram – Pipes in series and parallel – Equivalent pipe - Pipe network	9
DIMENSIONAL ANALYSIS		
V	Units and Dimensions – Dimensional homogeneity – Rayleigh's method – Buckingham's Pi theorem – Hydraulic similitude – Model studies	9
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Comprehend the properties of fluids
 - CO2: Understand the working of pressure measuring devices 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 – Streeter V.L., Wylie E. B. and Bedford K. W., "Fluid Mechanics", Tata McGraw Hill Publishing Co. Ltd., 2017.
T2 - Modi P. N. and Seth S M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2013.

REFERENCE BOOKS:

- R1 - Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.
R2 - Kumar .K.L., "Engineering Fluid Mechanics", Eurasia Publishing House, 2002.
R3 - Pani B.S., "Fluid Mechanics: A concise introduction" PHI Learning EEE 2016.
R4 - Narayana Pillai N. "Principles of Fluid Mechanics and Fluid Machines", 3rd. Ed. University Press (India) Pvt. Ltd. 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE3202	GEOLOGY AND CONSTRUCTION MATERIALS	3	0	0	3

- Course Objective**
1. To describe the geological processes, structures and their importance in construction projects
 2. To discuss the fundamental properties of minerals and their application in Civil Engineering
 3. To classify and characterize the various types of rocks, its engineering properties and uses
 4. To introduce students to materials commonly used in civil engineering and their properties
 5. To illustrate the properties and applications of other miscellaneous materials and finishes

Unit	Description	Instructional Hours
	PHYSICAL AND STRUCTURAL GEOLOGY	
I	Geology in civil engineering – Branches of geology – Structure of Earth and its composition Weathering of rocks – Soils - Landforms and processes associated with river, wind and sea – Study of structures – Folds, Faults and Joints – Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings.	9
	MINEROLOGY	
II	Physical properties of minerals – Quartz group - Feldspar group - Pyroxene (Hypersthene and Augite) – Amphibole (Hornblende) – Mica (Muscovite and Biotite) – Calcite – Gypsum - Clay minerals (Kaolin) - Ore minerals (Iron ores, Chromite, Bauxite, Chalcopyrite) – Coal and Petroleum.	9
	PETROLOGY	
III	Classification of rocks - Distinction between Igneous, Sedimentary and Metamorphic rocks - Engineering properties of rocks - Description, occurrence, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.	9
	BUILDING MATERIALS	
IV	Bricks – manufacture, types, properties, uses, Building Stones – types & uses, , Cement – manufacture, types, properties, Mortar - types & properties, Concrete – ingredients, properties, types, uses, Concrete Mixes, Grades, Steel – plain and deformed bars, relative merits – RCC – uses, merits and demerits.	9
	MISCELLANEOUS MATERIALS AND FINISHES	
V	Timber products – properties, application - Tiles - Ceramics – Refractories - Terracotta and Glazed products - Rubber – Plastics – Fibres and Composites – m-sand - Aluminium – Glass – Asbestos - Paints – Varnishes – Distempers – Emulsions	9
	Total Instructional Hours	45

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

- Course Outcome**
- CO1: Understand the importance of geological knowledge in Civil Engineering
 - CO2: Identify the minerals present in the building materials
 - CO3: Characterize the engineering properties of rocks and soils
 - CO4: Distinguish and select the various construction materials used in concrete
 - CO5: Compare the typical and potential applications of other miscellaneous materials and finishes

TEXT BOOKS:

- T1 - Venkat Reddy, D. "Engineering Geology", Vikas Publishing House Pvt. Ltd., New Delhi, 2010.
- T2 - Parbin Singh, "Engineering and General Geology", S. K. Kataria and Sons, New Delhi, 2014.
- T3 - Duggal, S.K., "Building Materials", New Age International, New Delhi, 2009.

REFERENCE BOOKS:

- R1 - Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and Geotechnics", CBS Publishers and Distributors, New Delhi.
- R2 - Varghese, P.C., "Engineering Geology for Civil Engineering", Prentice Hall of India Learning Private Limited, New Delhi, 2012.
- R3 - Shetty, M.S., "Concrete Technology", S Chand and Company, 2011.
- R4 – Rangwala, "Engineering Materials", Charotar Publishing House Pvt. Ltd., Anand, Gujarat, 2019.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE3203	SURVEYING	3	0	0	3

- Course Objective**
1. To introduce the principles of surveying and levelling
 2. To learn the various methods of Theodolite surveying and Contouring
 3. To introduce the concepts of Control Surveying
 4. To acquire knowledge on working principle of EDM and Total Station
 5. To study the principles of map projections and GIS

Unit	Description	Instructional Hours
	INTRODUCTION OF SURVEYING AND LEVELLING	
I	Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass - Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing - Levelling- Principles and theory of Levelling - Datum - Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling - Booking Reduction - Sources of errors in Levelling	9
	THEODOLITE SURVEYING AND COUNTOURS	
II	Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometry surveying - Contour – Characteristics of contours – Methods of contouring – Contour gradient – Uses of contour plan and map	9
	CONTROL SURVEYING AND ADJUSTMENT	
III	Horizontal and vertical control – Methods – specifications – triangulation- baseline – satellite stations – trigonometrical levelling – traversing – Errors Sources- precautions and corrections – classification of errors – true and most probable values - weighed observations – principle of least squares - normal equation – level nets.	9
	ELECTRONIC DISTANCE MEASUREMENTS AND TOTAL STATION	
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	9
	CURVES AND GEOGRAPHICAL INFORMATION SYSTEM	
V	Introduction – Curves – Types of Curves – Long Chord, Rankine’s Method – Maps – Map projections – Map analysis – GIS – Definition – Basic components of GIS - Standard GIS software – 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: Apply the basic principles of surveying and levelling
 - CO2: Measure horizontal angle and vertical angle using theodolite
 - CO3: Take suitable precautions and apply necessary corrections in surveying
 - CO4: Apply principles of EDM and use total station in surveying
 - CO5: Interpret topographic maps and applications of GIS

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, A., Raymond, S., Baker, R., "Surveying", Pearson Education Ltd., 7th Edition, 2009.
R3 - Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2010.
R4 - Arora, K. R., "Surveying Vol I & II", Standard Book House, Twelfth Edition, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE3251	MECHANICS OF SOLIDS	2	0	2	3

- 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 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 - Hooke's law - Poisson's ratio - Elastic constants – Relationship between elastic constants - Thermal stresses in compound bars. Tension Test, Compression Test	6+4(P)
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 for simply supported, cantilever and overhanging beams	6
STRESSES IN BEAMS		
III	Introduction - Pure bending and non-uniform bending - Curvature of a beam – Bending stresses in beams – Shear stresses in beams of rectangular, circular, T and I sections. Deflection Test, Shear Test	6+4(P)
PRINCIPAL STRESS AND STRAIN		
IV	Plane stress - Principal stresses and maximum shear stress - Determination of principal stresses and principal planes - plane strain - Applications of plane stress.	6
TORSION OF SHAFTS AND SPRING		
V	Torsional deformations of a circular bar – Non uniform torsion - Stresses and strains in pure shear - transmission of power by circular shafts - Strain energy in torsion and pure shear - Springs – Types - Stresses and deflection of springs Torsion Test, Impact Test, Test on Springs	6+6(P)
Total Instructional Hours		45

- 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 beams
- CO3: Analyse the beam for bending and shear stresses
- 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

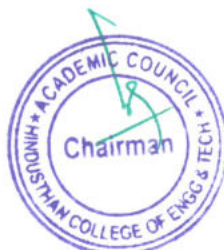
TEXT BOOKS:

- T1 - Bansal R.K. "A Textbook of Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, 2018
T2 - Rajput R K., "A Textbook of Strength of Materials", S. Chand Publishing, New Delhi, 2018

REFERENCE BOOKS:

- R1 - William A. Nash, "Strength of Materials", Schaum's Outline Series, Tata McGraw-Hill Publishing Co., New Delhi, 2008
R2 - Ramamrutham S. and Narayanan R., "Strength of Materials", Dhanpat Rai Publishing Co. (P) Ltd., 2011.
R3 - Gambhir M L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.
R4 - James M.Gere, "Mechanics of Materials", Thomas Canada Ltd., Canada, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE3002	COMPUTER AIDED BUILDING DRAWING	0	0	4	2

- Course Objective**
1. To understand the principles of planning and bylaws
 2. To draw plan, elevation and section of load bearing and framed structures
 3. To draw plan, elevation and section of residential, public and industrial structures
 4. To prepare detailed drawing for doors and windows

Expt . No.	Description of the Experiment
1.	Classification of buildings - Principles of planning – Dimensions of building
2.	Orientation of buildings – Lighting and Ventilation - Building bye-laws –FSI, Open spaces
3.	Introduction to AutoCAD
4.	Detailed drawings of component parts – Doors and Windows
5.	Planning and preparing sketches / drawings of Residential Building (Flat & Sloping Roof)
6.	Planning and preparing sketches / drawings of School and Hospital Building
7.	Planning and preparing sketches / drawings of single-storeyed factory buildings with trusses
8.	Building Information Modeling

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Apply the principles of planning and bye-laws for building planning
CO2: Prepare plan, elevation and section of residential buildings
CO3: Prepare plan, elevation and section of institutional and industrial buildings
CO4: Prepare detailed drawings of building component parts such as doors and windows
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 and Brian C. Benton, "Mastering AutoCAD 2019 and AutoCAD LT 2019", John Wiley & Sons, 2018.


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, 2007.
R2 - Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 2010.
R3 - Marimuthu V.M., Murugesan R. and Padmini S., "Civil Engineering Drawing-I", Pratheeba Publishers, 2008



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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MC3191	INDIAN CONSTITUTION	2	0	0	0

Course Objective
1. Sensitization of student towards self, family (relationship), society and nature 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals 3. Strengthening of self reflection 4. Development of commitment and courage to act

Unit	Description	Instructional Hours
BASIC FEATURES AND FUNDAMENTAL PRINCIPLES		
I	Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	4
FUNDAMENTAL RIGHTS		
II	Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.	4
PARLIAMENTARY FORM OF GOVERNMENT		
III	The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions: National emergency, President rule, Financial emergency.	4
LOCAL GOVERNANCE		
IV	Local self government - constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article 19 – scope of the right to life and personal liberty under article 21	4
INDIAN SOCIETY		
V	Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	4
Total Instructional Hours		20

Course Outcome
Upon completion of the course, students will be able to CO1: Understand the functions of the Indian government. CO2: Understand and abide the rules of the Indian constitution

TEXT BOOKS:

- T1 - Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 1997.
T2 - Agarwal R C., "Indian Political System", S.Chand and Company, New Delhi, 1997.
T3 - Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi.
T4 - Sharma K L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

REFERENCE BOOKS:

- R1 - Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
R2 - Gahai U R., "Indian Political System", New Academic Publishing House, Jalaendhar.
R3 - Sharma R N., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.

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Course code

19HE3072

Pre-requisite

Course title

CAREER GUIDANCE LEVEL III
Personality, Aptitude and Career Development
None

L T P C
2 0 0 0

Syllabus version
1

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Display good writing skills while dealing with essays [SLO 12]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes (SLO): 6, 7, 8, 12

Module:1 Logical Reasoning 6 hours SLO:6
Clocks, calendars, Direction sense and Cubes

- Clocks
- Calendars
- Direction Sense
- Cubes

Data interpretation and Data sufficiency

- Data Interpretation – Tables
- Data Interpretation - Pie Chart
- Data Interpretation - Bar Graph
- Data Sufficiency

Module:2 Quantitative Aptitude 7 hours SLO: 7
Time and work

- Work with different efficiencies
- Pipes and cisterns
- Work equivalence
- Division of wages

Time, Speed and Distance

- Basics of time, speed and distance
- Relative speed
- Problems based on trains
- Problems based on boats and streams
- Problems based on races

Profit and loss, Partnerships and averages

- Basic terminologies in profit and loss
- Partnership
- Averages
- Weighted average

Module:3 Verbal Ability 5 hours SLO: 8
Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions



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- Determiners

Sentence Completion and Para-jumbles

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Module:4 Writing skills for placements 2 hours SLO: 12

Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of Studies

Approved by Academic Council

Date


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Programme B.E.	Course Code 19HE3073	Name of the Course LEADERSHIP MANAGEMENT SKILLS	L 1	T 0	P 0	C 0
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- Course Objective**
1. To know about the leadership skills that is to be acquired for success.
 2. To become a teamwork expert, real world problem solver, your views will be challenged
 3. To gain global perspective and becoming an effective communicator
 4. To understand about learning, negotiation and decision making
 - 5: To get first hand information about the skills we possess and to work on improvement.

Module	Description	Instructional Hours
1.	Strategic thinking skills	
2.	Planning and Delivery skills	
3.	People management skills (Delegation)	
4.	Change management and Innovation skills	
5.	Communication skills	
6.	Persuasion and influencing skills	
7.	Learning Agility	
8.	Motivation	
9.	Personality	
10.	Emotions	
11.	Perception	
12.	Negotiation	
13.	Decision making	
14.	Problem solving	
15.	Building trust	
Total Instructional Hours		15

- Course Outcome**
- CO1: To practice essential leadership skills in day to day operations
CO2: To work on leadership skills in the study environment
CO3: To understand and develop the skills consciously.
CO4: To know about the real worth of all the skills for success
CO5: To Analyze the real worth of the person and suggestion for improvement

TEXT BOOKS

- T1: A REVIEW OF LEADERSHIP THEORY AND COMPETENCY FRAMEWORKS, Bolden, R., Gosling, J., Marturano, A. and Dennison, P. June 2003
T2: LEADING FROM WITHIN: Building Organizational Leadership Capacity-David R. Kolzow, PhD, 2014

REFERENCE BOOKS

- R1: Seven habits of highly effective people – Stephen R.Covey
R2: The Art of Business Leadership: Indian Experiences – G.Balasubramaniam
R3: DEVELOPING the LEADER WITHIN YOU-JOHN C. MAXWELL

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA4103	PROBABILITY AND STATISTICS	3	1	0	4

- Course Objective**
1. Construct a well defined knowledge of random variables
 2. Explain the concept of two dimensional random variables and determine covariance
 3. Introduce Correlation concepts to understand the relation between two random variables
 4. Describe some basic concepts of statistical methods for testing the hypothesis
 5. Analyze the design of experiment techniques to solve various engineering problems

Unit	Description	Instructional Hours
PROBABILITY AND RANDOM VARIABLE		
I	Random variable –Discrete and continuous random variables – Probability mass function - Probability density function – Cumulative distribution functions - Moment generating functions.	12
TWO DIMENSIONAL RANDOM VARIABLES		
II	Joint probability mass function - Joint probability density function – Marginal Probability mass function – Marginal probability density function - Conditional Probability mass function - Conditional Probability density function – Independent random variables.	12
CORRELATION AND REGRESSION		
III	Correlation – Karl Pearson’s correlation coefficient – Spearman’s Rank Correlation – Regression lines (problems based on Raw data only).	12
HYPOTHESIS TESTING		
IV	Large sample test based on Normal distribution - test of significance for single mean and difference of means - Small sample test – t test for single mean and difference of mean - F distribution for variance, Chi – Square test for independence of attributes – Goodness of fit.	12
ANALYSIS OF VARIANCE		
V	Introduction, assumptions of analysis of variance, completely randomized design, randomized block design, Latin square design.	12
Total Instructional Hours		60

- Course Outcome**
- CO1: Understand the concepts of random variables
CO2: Express the phenomenon of two dimensional random variables
CO3: Compute correlation and predict unknown values using regression
CO4: Understand the concepts of statistical methods for testing the hypothesis
CO5: Apply Design of Experiment techniques to solve various engineering problems

TEXT BOOKS:

- T1 - Saeed Ghahramani, “Fundamentals of probability with stochastic processes”, Prentice Hall New Jersey, 2016.
T2 - Medhi J, “Stochastic Processes”, New Age International Publishers, New Delhi, 2014.

REFERENCE BOOKS :

- R1- Ibe O.C., “Fundamentals of Applied Probability and Random Processes”, Elsevier, First Indian Reprint, 2010.
R2 - Mont Gomery C. “Applied statistics and Probability for Engineers”, 6th Edition, Wiley Publications.
R3 - Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE4201	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.	12
	THIN AND THICK CYLINDERS AND THEORIES OF ELASTIC FAILURE	
II	Thin cylinders – Circumferential stress – Longitudinal stress – Volumetric strain - Stresses in thick cylindrical shell– Lamé’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.	12
	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.	12
	DEFLECTION OF BEAMS	
IV	Deflection of beams - Castigliano’s theorem - Geometric methods - Double integration method – Macaulay’s method – Moment-Area method - Conjugate beam method.	12
	UNSYMMETRICAL BENDING	
V	Unsymmetrical bending- Symmetrical and unsymmetrical sections - Bending stresses in beams - Shear centre - Symmetric and unsymmetrical sections.	12
	Total Instructional Hours	60


- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Analyse the determinate trusses.
 - CO2: Determine the stresses developed in 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: Comprehend stresses 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.
T2 - Egor P Popov, “Engineering Mechanics of Solids”, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS:

- R1 - Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
R2 - Punmia B.C. “Theory of Structures” (SMTS) Vol I&II, Laxmi Publishing Pvt. Ltd., New Delhi 2018.
R3 - Srinath, L.S. “Advanced Mechanics and solids”, Tata-McGraw Hill Publishing Co. Ltd, 2005.
R4 – Beer, F.P. and Johnston, E.R., “Mechanics of Materials”, Tata McGraw Hill, Sixth Edition, New Delhi 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE4202	APPLIED HYDRAULICS AND HYDRAULIC MACHINERY	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 - Steady uniform flow: Chezy equation, Manning equation -Wide open channel -Specific energy -Critical flow and its computation - channel transition.	9
UNIFORM FLOW		
II	Uniform flow -Velocity measurement - Manning's and Chezy's formula - Determination of roughness coefficients - Determination of normal depth and velocity - Most economical sections - Non-erodible channels.	9
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 .	9
PUMPS		
V	Centrifugal pumps - 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.	9
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: Assess the performance of different pumps

TEXT BOOKS:

- T1 - Chandramouli 'Applied Hydraulics' YesDee Publishers, 2017
T2 – Rajput R.K., "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, 2010.
R3 - Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.
R4 - Subramanya K., "Flow in open channels", Tata McGraw Hill, New Delhi, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE4203	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 - BIS Classification of soil – Tests for specific gravity - Grain size distribution – Sieve analysis – Atterberg limits - Soil compaction – Theory, Field compaction methods – Standard proctor Compaction test - 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	Vertical Stress distribution in soil – Boussinesq equation – point load and line load - Westergaard's equation – Newmark's influence chart – principle, construction and use -Terzaghi's one dimensional consolidation theory — Components of settlement – immediate and consolidation settlement.	9
	SHEAR STRENGTH	
IV	Shear strength properties of cohesive and cohesion less soils – Mohr-Coulomb failure criterion – Use of Mohr's circle – relationship between principle stresses and shear parameters – shear strength tests - Direct shear, Unconfined Compression and Vane shear – Liquefaction of soil.	9
	SLOPE STABILITY	
V	Slope failure mechanisms – Types of slope failure – stability analysis of an infinite slope for cohesion less and cohesive 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: Apply the 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 - Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi, 2011.
T2 - Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2015.

REFERENCE BOOKS:

- R1 - Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2017.
R2 - Gopal Ranjan and Rao. P. "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd, New Delhi, 2014.
R3 - Braja M. Das, "Fundamentals of Geotechnical Engineering", Thomson Asia Pvt. Ltd., Singapore, 2010.
R4 - McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE4251	CONCRETE TECHNOLOGY	2	0	2	3

- Course Objective**
1. To understand the properties of ingredients of concrete
 2. To learn the properties and applications of chemical and mineral admixtures
 3. To gain knowledge on concrete design mix
 4. To study the behaviour of concrete at its fresh and hardened state
 5. To understand special concrete and their use

Unit	Description	Instructional Hours
CONCRETE – INGREDIENTS AND MANUFACTURE		
I	Concrete – Ingredients – Cement, Aggregates - Properties and tests - Quality of Water for mixing and curing - Production - Batching – Mixing –Transportation - Placing - Compacting – Curing Tests for cement: Fineness, Specific gravity, Normal consistency, Soundness, Setting time Test for CM: Compressive strength	7+10(P)
ADMIXTURES		
II	Accelerators – Retarders - Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline	7
CONCRETE MIX DESIGN		
III	Grades of Concrete - Factors influencing mix proportion - Mix design by ACI method and I.S. code method - Mix Design Examples.	7
TESTS ON FRESH AND HARDENED CONCRETE		
IV	Tests on fresh concrete - workability - Segregation and Bleeding – Tests on Hardened concrete - Compressive strength – Split tensile strength - Flexural strength – water absorption – permeability.	7
SPECIAL CONCRETE		
V	Ferrocement - Ready mix concrete - High Strength Concrete - High Performance Concrete - Self compacting concrete – Lightweight concrete –Fibre Reinforced concrete - Polymer concrete - Prestressed concrete – Techniques on prestressing.	7
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Understand the various requirements of cement, aggregates and water for making concrete.
CO2: Understand the effect of admixtures on properties of concrete
CO3: Design the concrete mix using ACI and IS code methods.
CO4: Determine the properties of fresh and hardened of concrete.
CO5: Understand the importance and application of special concretes.

TEXT BOOKS:

- T1 - Shetty, M.S., "Concrete Technology (Theory & Practice)", S.Chand and Co, Revised edition, 2015.
T2 - Gambhir, M.L., "Concrete Technology", Tata McGraw Hill, fifth edition, 2013.

REFERENCE BOOKS:

- R1 - Bhavikatti S.S., " Concrete Technology", I.K International Publishing House Pvt. Ltd., New Delhi, 2015
R2 - Neville, A. M., "Properties of Concrete", Pearson India, fifth edition, 2002
R3 - Kumar P Mehta, Paulo J M Monterio., "Concrete - Microstructure, Properties and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2016.
R4 - Santhakumar, A. R., "Concrete Technology", Oxford University Press India, New Delhi 2006.

CODE BOOKS:

- C1 - IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2009
C2 - ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, Published by American Concrete Institute (ACI), 2009

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE4001	SOIL MECHANICS LAB	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.

Exp No. Description of the Experiment

- 1 Test for moisture content
- 2 Specific gravity test
- 3 Sieve analysis
- 4 Test for Consistency limits (Liquid limit, Plastic limit and Shrinkage limits)
- 5 Field density test (core cutter and sand replacement method)
- 6 Standard Proctor's Compaction test
- 7 Permeability Test
- 8 Direct shear test in cohesion less soil
- 9 Unconfined compression test in cohesive soil
- 10 Laboratory vane shear test in cohesive soil
- 11 California bearing ratio test
- 12 Tri-axial compression test (Demonstration)

Total Instructional 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. and 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.	19MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

Course Objective

1. The course aims at imparting basic principles of thought process, reasoning and inferencing
2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature
3. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions
4. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition

Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies	4
Total Instructional Hours		20

Course Outcome

CO1: Ability to understand the structure of Indian system of life.
CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective

REFERENCE BOOKS:

- R1 - V. Sivamakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
R2 - Swami Jitmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
R3 - Fritzof Capra, Tao of Physics
R4 - Fritzof Capra, The wave of Life
R5 - V N Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Amakuan
R6 - Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
R7 - GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
R8 - RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
P R Sharma (English translation). Shodashang Hridayam

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Course code	Course title	L	T	P	C
19HE4072	CAREER GUIDANCE LEVEL IV	2	0	0	0
Pre-requisite	Personality, Aptitude and Career Development	Syllabus version			
	None	I			

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Crack mock interviews with ease [SLO 13]
- Be introduced to problem-solving techniques and algorithms [SLO 14]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes (SLO): 6, 7, 8, 13, 14

Module:1 Logical Reasoning 3 hours SLO:6
 Logical connectives, Syllogism and Venn diagrams

- Logical Connectives
- Syllogisms
- Venn Diagrams – Interpretation
- Venn Diagrams – Solving

Module:2 Quantitative Aptitude 6 hours SLO: 7
 Logarithms, Progressions, Geometry and Quadratic equations

- Logarithm
- Arithmetic Progression
- Geometric Progression
- Geometry
- Mensuration
- Coded inequalities
- Quadratic Equations

Permutation, Combination and Probability

- Fundamental Counting Principle
- Permutation and Combination
- Computation of Permutation,
- Circular Permutations
- Computation of Combination
- Probability

Module:3 Verbal Ability 2 hours SLO: 8
 Critical Reasoning

- Argument – Identifying the Different Parts (Premise, assumption, conclusion)
- Strengthening statement
- Weakening statement
- Mimic the pattern

Module:4 Recruitment Essentials 1 hour SLO: 12
 Cracking interviews - demonstration through a few mocks
 Sample mock interviews to demonstrate how to crack the:

- HR interview
- MR interview
- Technical interview

Cracking other kinds of interviews

- Skype/ Telephonic interviews
- Panel interviews



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- Stress interviews

Resume building – workshop

A workshop to make students write an accurate resume

Module:5 **Problem solving and Algorithmic skills**

8 hours

SLO: 12

- Logical methods to solve problem statements in Programming
- Basic algorithms introduced

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, Mock interviews, 3 Assessments with End Semester (Computer Based Test)

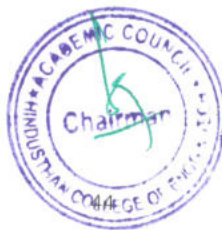
Recommended by Board of Studies

Approved by Academic Council

Date

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE4073	IDEATION SKILLS	1	0	0	0

- Course Objective**
- To study the importance of ideation.
 - To learn about the various tools for Ideation.
 - To provide an insight in Prototyping and its significance.

Unit	Description	Instructional Hours
IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY		
I	Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration – Implementation - Disruptive technology.	4
IDEATION: TOOLS FOR IDEATION		
II	Various resources to kindle new ideas for innovation. Explore the types of ideas in the past – Effect of the ideas and innovation of past on the world – Innovation Thinking – Case studies.	4
IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY		
III	Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
PROTOTYPING AND PRODUCT IDEATION		
IV	Introduction to Prototyping - minimum viable product - High fidelity prototype vs low fidelity prototype – Prototyping tools	3
Total Instructional Hours		15

- Course Outcome**
- Upon completion of the course, students will be able to
- CO1: Develop a strong understanding and importance of ideation
CO2: Learn about the different kinds of tools for Ideation.
CO3: Learn the need and significance of prototyping and its significance.

TEXT BOOKS:

- T1 - Mark Baskinger and William Bardel, "Drawing Ideas: A Hand-Drawn Approach for Better Design", 2013
T2 - Nigel Cross, "Design Thinking", Kindle Edition

REFERENCE BOOKS:

- R1 - Kurt Hanks and Larry Belliston, "Rapid Viz: A New Method for the Rapid Visualization of Ideas", 2008.
R2 - Kathryn McElroy, "Prototyping for Designers: Developing the Best Digital and Physical Products", 2017.

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SYLLABUS


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5201	STRUCTURAL ANALYSIS I	3	0	0	3

Course Objective
1. To Analyze the Beams and Frames by energy Method, unit load method and Theorem of three moments.
2. To analyze arched structures
3. To analyze the determinate structures for internal forces by slope deflection method.
4. To calculate the internal forces on determinate structures by moment distribution method.
5. To learn about basic concepts in influence lines for statically determinate structures

Unit	Description	Instructional Hours
	ANALYSIS OF BEAMS AND FRAMES	
I	Determination of Static and Kinematic Indeterminacies - Degree of Freedom - Analysis of beams, frames by energy method (up to redundancy two)-Principle of Virtual Work - unit load method- Maxwell reciprocal theorem -Analysis of Continuous Beams by Theorem of three moments.	9
	ARCHES	
II	Arches as structural forms – Types of arches (definitions based on shape and number of centers) – Analysis of three hinged and two hinged parabolic and circular arches- Settlement and temperature effects.	9
	SLOPE DEFLECTION METHOD	
III	Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames – Rigid frames with inclined members - Support settlements- Symmetric frames with symmetric and skew-symmetric loadings	9
	MOMENT DISTRIBUTION METHOD	
IV	Stiffness and carry over factors – Distribution and carryover of moments - Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement - Symmetric frames with symmetric and skew-symmetric loadings	9
	MOVING LOADS AND INFLUENCE LINES	
V	Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.	9
Total Instructional Hours		45

Course Outcome
Upon successful completion of the course, students will have ability to
CO1: Determine the deflection of beams, trusses and frames by energy and unit load method
CO2: Analyse three hinged and two hinged parabolic arches
CO3: Analyse the continuous beams and rigid frames by slope deflection method
CO4: Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway
CO5: Draw the influence lines for statically determinate structures

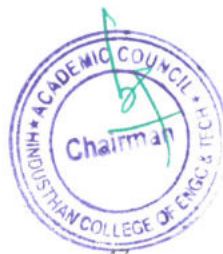
TEXT BOOKS:

T1 -Vaidyanathan, R. and Perumal, P., "Structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 4th Edition 2018.
T2 - Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 13th Edition, 2017

REFERENCE BOOKS:

R1 - Ramamrutham S., "Theory of Structures", Dhanpat Rai Publishing Company (P) Ltd., 9th Edition, 2019
R2 - Negi L.S. & Jangid R.S., "Structural Analysis", Tata McGraw Hill Publications, New Delhi, 6th Edition, 2010
R3 - Hibbeler R.C., "Structural Analysis", Pearson Education, 10th Edition, 2018
R4 - Devadas Menon, "Structural Analysis", Narosa Publishing House, 2nd Edition 2018

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5202	DESIGN OF RC ELEMENTS	3	1	0	4

- Course Objective**
1. To learn the basic concepts of design and to analyze and design RC beam by working stress method
 2. To gain knowledge on the design the RC beams by limit state method of design
 3. To learn the design concepts of RC slabs and staircases by limit state method
 4. To understand the design of columns by limit state method
 5. To gain knowledge on the design concept of RC footings by limit state method with reinforcement detailing.

Unit	Description	Instructional Hours
	INTRODUCTION Objective of structural design -Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC – Properties of Concrete and Reinforcing Steel - Design of Singly reinforced and doubly reinforced rectangular beams by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods	9+3
I	LIMIT STATE DESIGN OF BEAMS Design of singly reinforced and doubly reinforced rectangular beams by Limit State Method - Design of flanged beams – Behaviour of RC beams in shear, bond and anchorage - Design requirements as per IS code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion	9+3
II	LIMIT STATE DESIGN OF SLABS AND STAIRCASE Behaviour of one way and two way slabs – Design of one way simply supported, cantilever and continuous slabs – Design of two way slabs for various edge conditions – Torsion reinforcement at corners - Design of flat slabs - Types of Staircases – Design of dog-legged staircase	9+3
III	LIMIT STATE DESIGN OF COLUMNS Types of columns –Axially Loaded columns – Design of short rectangular, square and circular columns –Design of slender columns- Design for uniaxial and biaxial bending using column curves	9+3
IV	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+3
V		
Total Instructional Hours		45+15 = 60

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Illustrate the various design philosophies and design RC beam by working stress method
 - CO2: Design beams using limit state method under different loading and end conditions
 - CO3: Design slabs and staircases 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", Laxmi Publications (P) Ltd., New Delhi, 2007.
T2 - Unnikrishna Pillai, S., Devdas Menon. "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2016.

REFERENCE BOOKS:

- R1 - Sinha, S.N., "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2017.
R2 - Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2008.
R3 - Krishna Raju, N., "Design of Reinforced Concrete Structures". CBS Publishers & Distributors, New Delhi, 2019.
R4 - Krishna Raju, N., Pranesh R N., " Reinforced Concrete Design – Principles and Practice", New Age International Publishers, 2018.

CODE BOOKS:

- C1 – IS 456:2000 (R2016), "Code of practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi, 2016.
C2 – SP 16:1980 "Design Aids for Reinforced Concrete to IS456:1978", Bureau of Indian Standards, New Delhi, 1999.



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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5203	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 knowledge on the conveyance system and its components
 3. Learn the unit operations and understand the design of various components of water treatment plants.
 4. Understand 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 OF WATER	
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 - Plain sedimentation tanks - Principles & functions of chemical feeding, flash mixers, flocculators- Sand filters – Disinfection – Residue management – Construction, operation and maintenance of water treatment plants.	9
	ADVANCED WATER TREATMENT	
IV	Principles and functions of aeration – Iron and manganese removal – Defluoridation and Demineralisation – Water softening – Desalination - Membrane systems – Recent advances.	9
	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 – Rural water supply.	9
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Understand the importance of water quality standards and forecast population to determine the rate of consumption
- CO2: Interpret the various conveyance systems and its components
- CO3: Classify and design the various components of the water treatment plant
- CO4: Compare various advanced water treatment methods
- 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, 2017.
- 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", Dhanpat Rai & Sons, 2012.
- R2 - Modi, P. N, "Water Supply Engineering" Vol. I, Standard Book House, New Delhi, 2010.
- R3 - Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
- R4 - Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning, Design and Operation", Prentice Hall of India Learning Private Limited, New Delhi, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5204	FOUNDATION ENGINEERING	3	0	0	3

- Course Objective**
1. To understand various methods of site 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 –Methods 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) - Data Interpretation - Strength parameters and Evaluation of liquefaction potential - Selection of foundation based on soil condition - 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 –Factors affecting bearing capacity - Allowable bearing capacity –Bearing capacity from plate load test and in-situ tests (SPT & SCPT) -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 – Types and proportioning of Isolated footing, Combined footing and Mat foundation - Contact pressure and settlement distribution below footing - Floating foundation - Foundation stitch slab – Grade slab – Rock anchoring - Codal provision - Seismic force consideration.	9
	PILE FOUNDATION	
IV	Types of piles and their function – Factors influencing the selection of pile - Load carrying capacity of single pile in granular and cohesive soil - Static & Dynamic formulae (Engineering News and Hileys) - Pile load tests - Negative skin friction –Group capacity by different methods (Feld's rule, Converse Labarre formula and block failure criterion) – Settlement of pile group - Under reamed piles – Capacity under compression and uplift – Pull out test - Codal provision	9
	RETAINING WALLS	
V	Plastic equilibrium in soil - Active and passive states - Rankine's theory – Cohesionless and Cohesive soil - Coulomb's wedge theory – Conditions for critical failure plane -Earth pressure on retaining walls of simple configuration –Culmann's graphical method – Pressure on wall due to line load - stability analysis of retaining wall – Codal provisions.	9
Total Instructional Hours		45

Course Outcome

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

CO1: Select the suitable method of site 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, 2017.
T2 - Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors Ltd., New Delhi, 2014

REFERENCE BOOKS:

- R1 – Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2017.
R2 - Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", Pearson Education, 2nd Edition, 2013.
R3 - Gopal Ranjan and Rao A.S.R. "Basic and Applied Soil Mechanics". New Age International (P) Ltd. New Delhi, 2006.
R4 - Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5205	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
	HIGHWAY PLANNING AND ALIGNMENT	
I	Historical Development of Road Construction – Highway Development in India – Institutions for Highway Development at National Level – Requirements of and Factors Affecting the 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
	PAVEMENT DESIGN	
II	Rigid and Flexible Pavements – Components and their functions – Design principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements – ESAL, Climate, Sub-grade soil and Traffic – Design Practice for Flexible and Rigid Pavements (CBR Method, IRC Method and Recommendations – Problems) – Joints.	9
	HIGHWAY MATERIALS, MAINTENANCE AND REHABILITATION	
III	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	9
	RAILWAY PLANNING, DESIGN AND SIGNALLING	
IV	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, Coming 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-Signaling.	9
	RAILWAY MAINTENANCE AND MODERNIZATION	
V	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 – Re-laying of tracks -Modern methods of construction & maintenance – Railway stations and yards – layouts - passenger amenities – Urban rail – Infrastructure for Metro, Mono and Underground railways – Introduction of hyper loop.	9
	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 the railway tracks.
CO5: Appreciate the need for modernization of tracks for speed trains.

TEXT BOOKS:

- T1- Khanna, S. K. and Justo, C.E.G., "Highway Engineering", Nem Chand and Brothers, Roorkee, 2015.
T2- SaxenaSubhash, C. and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi, 2003.

REFERENCE BOOKS:

- R1- Bindra, S.P. "Highway Engineering", Dhanpat Rai and Sons, New Delhi, 2014.
R2- Kadiyali, L.R. "Principles and Practice of Highway Engineering", 8th edition, Khanna Technical Publications, New Delhi, 2013
R3- Rao, G.V., "Principles of Transportation Engineering", Tata McGraw Hill Publication, New Delhi, 2017.
R4- Subramanian, K.P., "Highways, Railways, Airport and Harbour Engineering", V Scitech Publications (India), Chennai, 2010.

CODE BOOKS:

- C1 - IRC 58 - 2015: Guidelines for Design of Plain Jointed Rigid Pavement
C2 - IRC 37 - 2018: Guidelines for Design of Flexible Pavements

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5001	CONCRETE AND HIGHWAY ENGINEERING LAB	0	0	4	2

- Course Objective**
- To study the properties of constituent materials of concrete
 - To gain knowledge on the tests on fresh concrete
 - To learn the tests on hardened concrete and how the different materials shall modify the performance of concrete
 - To know the properties of bitumen and to study the various tests carried out on aggregates
 - To understand the techniques to characterize the materials in concrete and highway

Expt. No.	Description of the Experiment	
1.	<p>TESTS ON AGGREGATES</p> <p>Determination of Specific Gravity of Aggregates</p> <p>Determination of Fineness Modulus of Aggregates</p> <p>Determination of Water Absorption of Aggregates</p> <p>Determination of Flakiness and Elongation Indices of Coarse Aggregates</p> <p>Determination of Crushing strength, Impact Strength and Abrasion of Coarse Aggregates</p>	
2.	<p>TESTS ON FRESH CONCRETE</p> <p>Determination of workability by Slump and Compaction Factor Test</p> <p>Determination of workability by using Flow Table and Vee Bee Consistometer</p>	
3.	<p>TESTS ON HARDENED CONCRETE</p> <p>Determination of Compressive Strength and Split Tensile Strength of Concrete Specimens</p> <p>Determination of Flexural Strength and Modulus of Elasticity of Concrete Specimens</p>	
4.	<p>TESTS ON BITUMEN</p> <p>Determination of Softening Point and Penetration Index of Bitumen</p> <p>Determination of Density and Specific Gravity of Bituminous Mixture</p> <p>Determination of Ductility of Bitumen</p> <p>Determination of Marshall Stability and Flow Value of Bituminous Mixture</p>	
Total Practical Hours		45

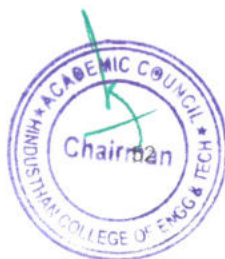
- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Interpret the properties of aggregates
- CO2: Carry out various tests to determine flow properties of fresh concrete
- CO2: Conduct tests to demonstrate and determine the strength of hardened concrete
- 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 - Gambhir, M.L., NehaJamwal, "Building and Construction Materials – Testing and Quality Control (LabManual)", McGraw Hill Education (India) Private Limited, New Delhi, 2014.
- R2 - Shetty, M. S., "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.	19CE5002	SURVEY CAMP	0	0	0	1

- Course Objective**
1. To enhance the practical skill in surveying under actual field conditions
 2. To learn the various types of setting out works
 3. To get conversant with the operating procedures of total station
 4. To gain knowledge on topographical surveying and preparation of topographical map
 5. To understand the significance and principles of horizontal and vertical control network

Expt. No.	Description of the Experiment	Total Practical Hours
1.	<p>Setting out work</p> <p>Setting out simple road curve by linear method</p> <p>Setting out simple railway curve by Instrument method</p> <p>Setting out work using Total Station (Spread footing marking for residential building)</p>	1 week
2.	<p>Preparation of topographic map</p> <p>Measurement of Area using Total Station</p> <p>Establishment of Horizontal Control Network (Grid Contouring) using Total Station</p> <p>Establishment of Vertical Control Network (Radial Contouring) using Total Station</p>	

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Carry out various surveying works based on actual field conditions
- CO2: Conduct different types of setting out works
- CO3: Follow the standard operating procedure when measuring an area using total station
- CO4: Perform topographical surveying and prepare the topographical map of an area
- CO5: Establish horizontal and vertical control network using total station

REFERENCE BOOKS:

- R1 - James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", McGraw Hill, 7th Edition, 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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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE5071	SOFT SKILLS - I	1	0	0	1

Course Objective	Description
6.	To employ soft skills to enhance employability and ensure workplace and career success.
7.	To enrich students' numerical ability of an individual and is available in technical flavor.
8.	To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	INTRODUCTION TO SOFT SKILLS Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills - Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	ART OF COMMUNICATION Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	WORLD OF TEAMS Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making	3
IV	QUANTITATIVE APTITUDE Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	LOGICAL REASONING Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2
Total Instructional Hours		15

Course Outcome	Description
CO1:	Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path
CO2:	Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
CO3:	Students will understand how teamwork can support leadership skills
CO4:	Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them
CO5:	Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems

REFERENCE BOOKS:

- R1 - Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz.
- R2 - How to prepare for data interpretation for CAT by Arun Sharma.
- R3 - How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
- R4 - A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
- R5 - Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE5072	DESIGN THINKING	1	0	0	1

- Course Objective**
1. To expose students to the design process
 2. To develop and test innovative ideas through a rapid iteration cycle
 3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
	DESIGN ABILITY	
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	4
	DESIGNING TO WIN	
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
	DESIGN TO PLEASE AND DESIGNING TOGETHER	
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
	DESIGN EXPERTISE	
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert	3
Total Instructional Hours		15

- Course Outcome**
- Upon completion of the course, students will be able to
- CO1: Develop a strong understanding of the Design Process
 - CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
 - CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition

REFERENCE BOOKS:

R1 - Tom Kelley, "Creative Confidence", 2013.

R2 - Tim Brown, "Change by Design", 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6201	STRUCTURAL ANALYSIS II	3	0	0	3

- Course Objective**
- To gain the knowledge on the analysis by flexibility method.
 - To gain knowledge on the analysis by stiffness matrix method.
 - To analyze the elements by finite element method.
 - To calculate the forces on indeterminate structures by plastic analysis.
 - To learn about basic concepts in space and cable structures.

Unit	Description	Instructional Hours
	FLEXIBILITY METHOD	
I	Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy - Primary structure – Compatibility conditions – Formation of flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).	9
	STIFFNESS METHOD	
II	Restrained structure –Formation of stiffness matrices - Equilibrium condition - Analysis of Continuous Beams - Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of Pin-jointed plane frames and rigid frames (with redundancy limited to two) by direct stiffness method.	9
	FINITE ELEMENT METHOD	
III	Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements	9
	PLASTIC ANALYSIS OF STRUCTURES	
IV	Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge - Mechanism and collapse load - Static and kinematic methods – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.	9
	SPACE AND CABLE STRUCTURES	
V	Analysis of Space trusses using method of tension coefficients – Suspension cables – Equilibrium, Length and Anchorage of suspension cables - Suspension bridges with two and three hinged stiffening girders - Influence lines for three hinged stiffening girders.	9
	Total Instructional Hours	45

Course Outcome

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

CO1: Determine the member forces and displacements for trusses and analyse beams and frames by flexibility method

CO2: Analyse beams and frames by stiffness matrix method

CO3: Discrete and analyse different elements by finite element method

CO4: Analyse the beams and frames by plastic analysis

CO5: Appraise the structural behavior of cable and space structures

TEXT BOOKS:

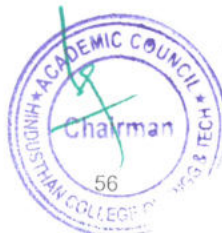
- T1 – Vaidyanathan, R. and Perumal, P., "Structural Analysis – Vol.I & II", Laxmi Publications, New Delhi, 4th Edition 2018.
- T2 - Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 13th Edition 2017

REFERENCE BOOKS:

- R1 – Devadas Menon, "Structural Analysis", Narosa Publishing House, 2nd Edition 2018
- R2 – Pandit G.S., Gupta S.P. and Gupta, "Theory of structure (vol II)", Tata McGraw Hill, 2017.
- R3 – William Weaver Jr. & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, Delhi, 2018.
- R4 – Hibbeler, R.C., "Structural Analysis", Pearson Education, 10th Edition, 2018.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6202	DESIGN OF STEEL STRUCTURAL ELEMENTS	3	0	0	3

- Course Objective**
- To understand the concept of limit state design and design of connections
 - To gain knowledge on the design of tension members
 - To gain knowledge on the design of compression members
 - To get familiar with the design of beams, plate girders, stiffeners and web splices
 - To learn the design of industrial structures

Unit	Description	Instructional Hours
	DESIGN OF CONNECTIONS	
I	Properties of steel -Structural steel sections –Limit state design concepts – Loads on structures – Connections – Design of 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 – Basis 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 - Design of Column splices.	9
	BEAMS	
IV	Design of laterally supported and unsupported beams – Beams subjected to uniaxial and biaxial bending -Built up beams – Design of Plate Girders – Intermediate and bearing stiffeners –Flange and 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 Outcome

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

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

TEXT BOOKS:

- T1 - Gambhir, M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., New Delhi, 2013.
T2 - Shiyekar, M.R., "Limit State Design in Structural Steel", Prentice Hall of India Learning Pvt. Ltd., 2nd Edition, 2013.

REFERENCE BOOKS:

- R1 - Bhavikatti S.S., "Design of Steel Structures", I. K. International Publishing House Pvt. Ltd., 2009.
R2 - Negi L.S., "Design of Steel Structures", Tata McGraw Hill Education India Pvt. Ltd., New Delhi, 2008.
R3 - Gaylord, E.H., Gaylord, N.C., and Stallmeyer, J.E., "Design of Steel Structures", McGraw-Hill Publications, 2010.
R4 – Dayarathnam P., "Design of Steel Structures", S Chand Publishers, New Delhi, 2012.

CODE BOOKS:

- C1 - IS 800:2007 General Construction In Steel - Code of Practice, Bureau of Indian Standards, New Delhi, 2007
C2 – SP6(1)-1964 - Handbook for Structural Engineers –Part 1- Structural Steel Sections, Bureau of Indian Standards, New Delhi, 1974.
C3 - IS 875 (Part –3) 2015 - Design Loads (Other than Earthquake) for Buildings and Structures - Code of Practice – Part 3-Wind Loads, Bureau of Indian Standards, New Delhi.
C4 - Murugesan, R. & Arulmanickam, A. 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.	19CE6203	WASTEWATER ENGINEERING	3	0	0	3

- Course Objective**
- To understand the systems of sewerage and estimate the quantity of wastewater
 - To acquire knowledge on hydraulics and design of sewers
 - To study the characteristics and composition of sewage and understand the principles of primary sewage treatment
 - To learn the principles, components and working of various biological treatment processes
 - 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 - Population Equivalent - Estimation of sewage flow - Fluctuations in flow pattern - Estimation of storm runoff - Computation of design flow - Drainage in buildings - Sanitary fixtures / fittings - General layout of house drainage - street connections	9
II	DESIGN OF SEWERS AND ITS OPERATION Hydraulics of sewers - Self cleansing and non-scouring velocities - Full flow / partial flow conditions - Sewer sections and design - Sewer appurtenances - Materials for sewers - Sewer joints - Sewer laying and testing - Sewer ventilation, cleaning and maintenance - Sewage pumping - Types of pumps.	9
III	QUALITY OF SEWAGE AND PRIMARY TREATMENT Characteristics and composition of sewage - Effluent standards - Physical and chemical analysis - 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 - Sludge deposit.	9
IV	BIOLOGICAL TREATMENT OF SEWAGE Basic principles of biological treatment - Activated sludge process - Diffuser / Mechanical aeration - Extended aeration process - Trickling filters - Description and principle of operation of trickling filters - recirculation - Stabilization ponds - UASB - SBR - ASBR - Membrane Bioreactor - Constructed wetland - Septic tanks and effluent disposal system	9
V	SEWAGE DISPOSAL AND SLUDGE MANAGEMENT Disposal Methods - Dilution - self-purification of streams - Streeter Phelps equation - Oxygen sag curve - Zones of purification - Land disposal - Sewage farming, Sewage sickness- Objectives of sludge treatment - Properties and characteristics of sludge - Sludge digestion - Biogas Recovery - Sludge Thickening - Drying - Conditioning and dewatering - Sludge disposal - 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: Understand the principle of operation and design 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 Systems Part A, B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
R2 - Mark J. Hammer, Mark J. Hammer Jr, "Water and Wastewater Technology", Prentice Hall of India, 2012.
R3 - Metcalf and Eddy, "Wastewater Engineering - Treatment and Reuse", Tata Mc.Graw-Hill Company, New Delhi, 2010.
R4 - Syed R. Qasim, "Wastewater Treatment plants", CRC Press, Wasington D.C., 2010

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6204	CONSTRUCTION MANAGEMENT	3	0	0	3

- Course Objective**
1. To study the necessity of planning in the diverse construction projects
 2. To know the appropriate techniques used for scheduling the resources
 3. To have exposure on various costs, control methods and departmental procedure for accounting
 4. To study the quality control and monitoring techniques and the necessity of training to personnel
 5. To provide awareness on construction safety and management information system

Unit	Description	Instructional Hours
I	CONSTRUCTION PLANNING AND ETHICS Necessity - Basic concepts - Steps involved in planning - Phases and stages of project plan - Types of construction plans and construction projects - Resource Planning - Planning for materials, manpower, machinery, time and cost- Morals, Values, Work Ethics and Professional Rights -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	9
II	MANAGEMENT AND MONITORING 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 software application	9
III	CONTROL, FINANCING AND DEPARTMENTAL ACCOUNTING PROCEDURE Costs and estimates associated with construction - Means of financing - Financial assistance - Project budget - Cost control system and codes - Cost accounts - Financial control and financial accounting systems - Project cash flows - Elements and control mechanism - 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, TRAINING AND DOCUMENTATION 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 - Definition of tender and contract - Deposits - Earnest Money Deposit and Security deposit - Legal implications - Penalties and Arbitration.	9
V	MANAGEMENT INFORMATION SYSTEM Introduction of Project Management Principles, Objectives, Stages and Scope of Project Management, Introduction to Workflow Management Systems - Waterfall, Lean, Agile, PRINCE 2, Understanding the Project Construction, Scope of Work of the Project, Various Type of Structures, Preparation of Project Gist - Preparation of Scope of Work Pie Chart - Time Management & Resource Management, - Procurement & Cost Management - Quality Management - Risk management	9
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- CO1: Learn the requirement of planning techniques exercised in the construction projects
 - CO2: Choose suitable scheduling technique for the particular project
 - CO3: Interpret 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: Comprehend the aspects of management information system

TEXT BOOKS:

T1 - Chitkara, K.K., "Construction Project Management - Planning, Scheduling and Controlling", McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2012.

T2 - Jimmie W. Hinze, "Construction Planning and Scheduling", Prentice Hall Publication, 4th Edition, 2011.

REFERENCE BOOKS:

R1 - Halpin, D.W., "Financial and cost concepts for construction Management", John Wiley and Sons, New York, 2014

R2 - Willis, E.M., "Scheduling Construction projects", John Wiley and Sons, 2011.

R3 - Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2012.

R4 - Moder, J., Phillips, C. and Davis E, "Project Management with CPM, PERT and Precedence Diagramming", Van Nostrand Reinhold Co., 3rd Edition, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6001	WATER AND WASTEWATER TESTING LAB	0	0	3	1.5
Course Objective	1. Gain insight on sampling, preservation methods and the significance of characterization of water and wastewater 2. Study the characterization of water and wastewater samples as per BIS water quality and effluent standards 3. Learn to analyze and measure the various physical, chemical and biological parameters of water and wastewater 4. Understand the principles and operational procedures of modern instrumentation methods adopted in water quality testing 5. Get conversant with the water and wastewater specifications of IS / WHO					

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, Fixed, Volatile 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

Upon successful completion of the course, students will have ability to
 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: Compare and check the determined results with IS / WHO standards

REFERENCE BOOKS

- R1 – "Standard Methods for the Examination of Water and Wastewater", WPCF, APHA and AWWA, USA, 17th Edition, 2015.
- R2 - IS 10500:2012 "Drinking Water Specifications", Bureau of Indian Standards, New Delhi.
- R3 – "Manual on Sewerage & Sewage Treatment", Second Edition, CPHEEO, 2012.
- R4 - "Laboratory Manual for the Examination of Water, Wastewater, Soil, Rump", H.H. and Krist, H. – Second Edition, VCH, Germany, 3rd Edition, 1999.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6002	DESIGN AND DRAWING OF RC STRUCTURES	0	0	3	1.5

Course Objective
1. To understand the design and reinforcement detailing of Cantilever Retaining wall
2. To gain knowledge on the design and reinforcement detailing of Counter-fort Retaining wall
3. To acquire knowledge on the design and detailing of T beam Bridge
4. To learn the design concepts and reinforcement detailing of Circular water tank with dome
5. To acquire knowledge on the design and detailing of Underground water tank

Expt. No. Description of the Experiment

1. Design and Detailing of Cantilever retaining wall
2. Design and Detailing of Counter-fort Retaining wall
3. Design and Detailing of T beam Bridge for IRC loading
4. Design and Detailing of Circular water tank with Dome
5. Design and Detailing of Underground water tank

Total Practical Hours 45

Course Outcome
Upon successful completion of the course, students will have ability to
CO1: Design and prepare structural detailing of Cantilever Retaining walls
CO2: Design and prepare structural detailing of Counter-fort Retaining wall
CO3: Design and prepare structural detailing of T beam Bridge
CO4: Design and prepare structural detailing of Circular water tank with dome
CO5: Design and prepare structural detailing of Underground water tank

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.
R3 -Sinha, S.N., "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2015.
R4 -Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2010.
R5 - Krishnaraju N., "Design of Bridges", Oxford and IBH Publishing co. Pvt. Ltd, New Delhi and CBS Publishers & Distributors Pvt. Ltd. New Delhi., 2018.

CODE BOOKS:

- C1- IS 456:2000 (R2016), "Plain and Reinforced Concrete - Code of Practice", BIS, New Delhi, 2016.
C2- SP16:1980, "Design Aids for Reinforced Concrete to IS456:1978", BIS, New Delhi, 1999.
C3- IS 875 (Part 1, 2, 3):2015, "Indian Standard Specification for Design Loads for Buildings", BIS, New Delhi, 2015.
C4- IS 3370 (Part 1, 2):2009 and IS3370 (Part 4): 1967 (R2008), "Code of Practice for Concrete Structures for the Storage of Liquids", BIS, New Delhi, 2009.
C5- IRC 21:2000, "Standard specifications and code of practice for Road and Bridges – Section III – Cement Concrete (Plain and Reinforced)", IRC, New Delhi, 2000.
C6- IRC 112:2020, "Code of Practice for concrete Road Bridges", IRC, New Delhi, July 2020.



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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE6071	SOFT SKILLS – II	1	0	0	1

- Course Objective**
1. To make the students aware of the importance, the role and the content of softskills through instruction, knowledge acquisition, demonstration and practice.
 2. To learn everything from equations to probability with a completely different approach.
 3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
	GROUP DISCUSSION & PRESENTATION SKILLS	
I	GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
	INTERVIEW SKILLS AND PERSONALITY SKILLS	
II	Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
	BUSINESS ETIQUETTE & ETHICS	
III	Etiquette – Telephone & E-mail etiquette – Dining etiquette – do's& Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines	3
	QUANTITATIVE APTITUDE	
IV	Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration	3
	LOGICAL REASONING	
V	Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2
Total Instructional Hours		15

- Course Outcome**
- CO1: Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict
CO2: Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations
CO3: Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment
CO4: Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems
CO5: Students will excel in complex reasoning

REFERENCE BOOKS:

1. R1 - Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent- Bruce Tulgan.
2. R2 -Quantitative Aptitude for Competitive Examinations (5th Edition) - AbhjitGuha.
3. R3 - How to crack test of Reasoning - Jaikishan and Premkishan
4. R4 - The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

Course Objective	Description
	1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries
	2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
	3. To disseminate knowledge on copyrights and its related rights and registration aspects.
	4. To disseminate knowledge on trademarks and registration aspects.
	5. To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
	INTRODUCTION TO INTELLECTUAL PROPERTY	
I	Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
	PATENTS	
II	Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
	COPYRIGHTS	
III	Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
	TRADEMARKS	
IV	Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks -Registration of Trademarks.	3
	DESIGN AND GEOGRAPHICAL INDICATION	
V	Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3
Total Instructional Hours		15

Course Outcome	Description
	CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP
	CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development
	CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing
	CO4: Identify different types of trademarks and procedure for registration
	CO5: Recognize the concept of design, geographical indication and procedure for registration

TEXT BOOKS:

- T1- Neeraj, P., &Khusdeep, D. Intellectual Property Rights: India, IN: PHI learning Private Limited, 2014.
T2- V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India Pvt. Ltd, 2012.

REFERENCE BOOKS:

- R1- Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
R2- Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5301	ADVANCED SURVEYING TECHNIQUES	3	0	0	3

- Course Objective**
1. To understand the fundamentals of Astronomical Surveying
 2. To learn the basics principles of Aerial Surveying
 3. To study the various Total Station Surveying
 4. To gain knowledge on GPS Surveying
 5. To enhance the knowledge on route surveys, hydrographic survey and tunnel alignments

Unit	Description	Instructional Hours
ASTRONOMICAL SURVEYING		
I	Astronomical terms and definition – Motion of sun and stars – Celestial co-ordinate System - Time system - Nautical Almanac – Apparent attitude and corrections – Field observations and determinations of time, longitude, latitude and azimuth by attitude and Hour angle method.	9
AERIAL SURVEYING		
II	Terrestrial Photogrammetry – Terrestrial stereo photogrammetry – Aerial photogrammetry – overlaps – Scale of photographs – Vertical and tilted photographs distortion in aerial photographs – Stereoscopic vision - Photo interpretation – Applications.	9
TOTAL STATION SURVEYING		
III	Methods of Measuring Distance - Basic Principles of Total Station - Historical Development, Classifications - Applications and comparison with conventional surveying - Classification - Applications of Electromagnetic waves - Propagation properties - Wave propagation at lower and higher frequencies.	9
GPS SURVEYING		
IV	Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler's Law - Perturbing forces – Geodetic satellite - Doppler effect - Positioning concept - GNSS, IRNSS and GAGAN - Different segments -Space, control and user segments - Satellite configuration – GPS signal structure – Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.	9
MISCELLANEOUS SURVEYING		
V	Reconnaissance – Route surveys for highways, railways and waterways – Simple, compound, reverse, transition and vertical curve – Setting out methods - Hydrographic surveying – Tides – MSL – Sounding methods – Measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies – Remote sensing.	9
Total Instructional Hours		45

Course Outcome

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

CO1: Understand the concepts of astronomical surveying
CO2: Understand the importance of photogrammetric surveying
CO3: Comprehend and apply the principles of Total Station Surveying
CO4: Interpret the principles of GPS surveying and data processing
CO5: Compare the concepts of route survey, hydrographic survey and tunnel alignments

TEXT BOOKS:

- T1 - Lillesand, T.M., Kiefer, R.W. and Chipman, J. W., "Remote Sensing and Image Interpretation", John Wiley and Sons Asia Pvt Ltd., New Delhi, 7th Edition, 2015
T2 - Anji Reddy, M., "Textbook of Remote Sensing and Geographical Information System", BS Publications, Hyderabad, 4th Edition, 2019.

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 - Arora, K. R., "Surveying Vol. I & II", Standard Book House, 10th Edition, 2008.
R3 - Peter A. Burrough, Rachael A. McDonnell, "Principles of GIS", Oxford University Press, 2015.
R4 - Ian Heywood, "An Introduction to GIS", Pearson Education Asia, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5302	TRAFFIC ENGINEERING	3	0	0	3

- Course Objective**
1. To provide an insight on traffic, its components and factors affecting road traffic
 2. To familiarize with various traffic surveys, interpretation and analysis
 3. To acquire knowledge on traffic intersection design
 4. To gain an insight on different traffic control systems
 5. To study the IRC traffic techniques

Unit	Description	Instructional Hours
	TRAFFIC CHARACTERISTICS	
I	Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.	9
	TRAFFIC SURVEYS AND ANALYSIS	
II	Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Basic principles of Traffic Flow.	9
	GEOMETRIC DESIGN OF INTERSECTIONS	
III	Conflicts at Intersections - Classification of Grade Intersections - Channelized Intersections - Principles of Intersection Design - Elements of Intersection Design - Rotary design, Grade Separation and interchanges - Design principles	9
	TRAFFIC SAFETY AND ENVIRONMENT	
IV	Road accidents – Causes, effect, prevention, and cost – Street lighting – Road safety – Objectives, Demographics - Traffic regulations - Basic Principles - Road Safety Policy - Motor vehicle act 1988 – Intersection safety - Traffic and environmental hazards – Air and Noise Pollution, causes, health effects and abatement measures.	9
	TRAFFIC TECHNIQUES	
V	IRC guidelines - Traffic Forecasting techniques - Restrictions on turning movements – One way Streets - Traffic Segregation - Traffic Calming - Tidal flow operations - Exclusive Bus Lanes - Introduction to Intelligent Transportation System (ITS) - Roles of ITS- Methods for traffic Management.	9
Total Instructional Hours		45

Course Outcome

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

CO1: Apply knowledge of traffic, its components and factors affecting road traffic in intersection design
CO2: Apply the knowledge of sampling data in conducting various surveys and analysis
CO3: Understand traffic movements and designing islands, intersections and road lightings
CO4: Interpret the causes, effects and prevention of road accidents
CO5: Comprehend the traffic regulations and techniques

TEXT BOOKS:

- T1- Kadiyali, L.R. 'Traffic Engineering and Transport Planning', Khanna Publishers, 2016.
T2 - Srinivasa Kumar, "Introduction to Traffic Engineering", Universities Press, 2018.

REFERENCE BOOKS:

- R1 – SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques for Urban Areas", 1994
R2 - Jotin Khisty C., Kent Lall, "Transportation Engineering-An Introduction", Prentice-Hall of India, New Delhi, 1998.
R3 – Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
R4 - Papacostas, C.A., "Fundamentals of Transportation Engineering", Prentice-Hall of India Private Limited, New Delhi 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5303	HOUSING PLANNING AND MANAGEMENT	3	0	0	3

- Course Objective**
1. To provide 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 familiar with housing finance and project appraisal

Unit	Description	Instructional Hours
	INTRODUCTION TO HOUSING	
I	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
	HOUSING PROGRAMMES	
II	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
	PLANNING AND DESIGN OF HOUSING PROJECTS	
III	Formulation of Housing Projects – Land Use and Soil suitability analysis -Building Byclaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) – Housing Project Formulation	9
	CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS	
IV	New Constructions Techniques – Cost Effective Modern materials and methods of construction- Green building concept- Benefits - Building Centers – Concept, Functions, Cost Effective Technologies and Performance Evaluation	9
	HOUSING FINANCE AND PROJECT APPRAISAL	
V	Appraisal of housing projects – Housing Finance, Cost Recovery – Cost Recovery Policy - Cash Flow Analysis, Subsidy and Cross Subsidy, Viability Gap Funding - 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: Interpret 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, 2020.
R2 - DhanalakshmiG ,Anbarasan . S, " Housing Planning And Management", KKS Publishers, 2012.
R3 - Chandra Sekar, K.,andKarthikeyan, N., "Housing Planning & Management", CGS Publications.2016.
R4 - "Development Control Rules for Chennai Metropolitan Area", CMA, Chennai, 2019.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5304	CONSTRUCTION TECHNIQUES, EQUIPMENT AND SAFETY	3	0	0	3

- Course Objective**
1. To understand the techniques used in the construction industry
 2. To recognize the application of various construction equipment
 3. To learn the construction practices in construction industry
 4. To familiarize with safety measures available in the construction practices
 5. To gain knowledge of super and sub structure construction methods and techniques

Unit	Description	Instructional Hours
I	CONSTRUCTION TECHNIQUES Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism - floor system - Development of construction techniques - High rise Building Technology - Seismic effect-Environmental impact of materials – responsible sourcing - Eco Building (Green Building) -Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent (Smart) buildings - Building automation - Energy efficient buildings for various zones - Case studies of residential, office buildings and other buildings in each zones.	9
II	CONSTRUCTION EQUIPMENTS Selection of Equipment for Earthwork – Earth Moving Operations – Types of Earthwork equipment – Tractors, Motor Graders, Scrapers, Front End Loaders, Earth Movers – Equipment for Foundation and Pile Driving – Equipment for Compaction, Batching, Mixing and Concreting – Equipment for Material Handling and Erection of Structures – Equipment for Dredging, Trenching and Tunneling - Ownership cost-Depreciation-Operating cost-Construction equipment maintenance.	9
III	CONSTRUCTION PRACTICES Specifications, details and sequence of activities and construction co-ordination –Site Clearance –Marking – Earthwork – Brick masonry – Stone masonry – Bond in masonry - Concrete hollow block masonry –Flooring –Damp proof courses – Construction joints – Movement and expansion joints –Building foundations – Basements – Temporary shed – Centering and shuttering – Slip forms – Scaffolding – De-shuttering forms – Frames – Braced domes – Laying brick – Weather and water proof – Roof finishes – Acoustic and fire protection.	9
IV	CONSTRUCTION SAFETY Construction Safety - Safety hazards, risks and accidents - Legal requirements – OSHA - Personal Protective Equipment (PPE) – Electrical Safety – Prevention - Fire Prevention and Control – Safety Signs and Signals – Safety training-Integration of safety and quality management –Impact of BIM-Mobile devices- - Types of safety practices -Excavations and Confined Spaces-scaffolding- Movement of materials.	9
V	SUB STRUCTURE AND SUPER STRUCTURE CONSTRUCTION Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement- Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation - Launching girders, bridge decks, off shore platforms – special forms for shells - in-situ pre-stressing in high rise structures - Materials handling	9
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students will have ability to
- CO1: Understand the techniques used in construction industry.
 - CO2: Enumerate the various equipments used in construction.
 - CO3: Recognize and construction practices in construction industry.
 - CO4: Identify and incorporate the safety practices in construction
 - CO5: Comprehend the techniques of sub-structure and super-structure construction

TEXT BOOKS:

- T1 - Arora S.P. and Brindra S.P., "Building Construction, Planning Techniques and Method of Construction". Dhanpat Rai and Sons, 2010.
T2 - Varghese, P.C. "Building Construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2015

REFERENCE BOOKS:

- R1 - Sharma, S.C., "Construction Equipment and Management", Khanna Publishers, New Delhi, 2008.
R2 - Rethaliya, R. P., "Advanced construction and equipments", AtulPrakashan Publishing, 2019.
R3 - Mishra, R. K., "Construction safety", Atbs Publishers, India, 2013
R4 - Peurifoy, R.L., Aviadshapira and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5305	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 - Introduction to Climate Change and its effects on Hydrological process.	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 - Methods of Artificial Recharge.	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 hydrometeorology.

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 Publishing Company, New Delhi, 2008.
- T2 - Santosh Kumar Garg, "Hydrology and Water Resources Engineering", Khanna Publications Pvt.Ltd., New Delhi, 2015.

REFERENCE BOOKS:

- R1 - Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishing Company, New Delhi, 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, New Delhi, 1992.
- R4 - Raghunath, H.M., "Hydrology- Principles, Analysis and Design", New Age International Pvt. Ltd., New Delhi, 2nd Edition, 2006.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE5306	PROFESSIONAL ETHICS AND LAWS FOR CIVIL ENGINEERS	3	0	0	3

- Course Objective**
1. To raise awareness on human values and engineering ethics
 2. To gain knowledge on social experimentation techniques and contract laws
 3. To understand the professional rights and responsibilities of engineers in the society
 4. To emphasize the significance and necessity of safety and risk assessment in engineering
 5. To gain an insight on the global issues in engineering

Unit	Description	Instructional Hours
	HUMAN VALUES AND ENGINEERING ETHICS	
I	Morals, Values and Ethics - Work Ethic - Team work - Service Learning - Respect for Others - Living Peacefully - Honesty - Courage - Time management - Team work - Commitment -Self-Confidence - Customs and religion - Senses of Engineering Ethics - Variety of moral issues - Types of inquiry, Moral dilemmas and Moral Autonomy - Kohlberg's Theory -Gilligan's Theory - Case studies and moral stories.	09
	SOCIAL EXPERIMENTATION AND CONTRACT LAWS	
II	Engineering as experimentation - Engineers as responsible experimenters - Codes of ethics - Sample code of conduct - A balanced outlook on Law - Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law, Building & Other Construction Workers Act (1996) and Rules (1998).	09
	RESPONSIBILITIES AND RIGHTS	
III	Collegiality and loyalty - Respect for Authority -Collective Bargaining - Confidentiality - Conflicts of Interest - Whistle Blowing - Occupational Crime - Professional Rights- Employee Rights - Intellectual Property Rights (IPR) - Case studies.	09
	SAFETY AND RISK ASSESSMENT	
IV	Safety and risk - Assessment of safety and risk - Risk Benefit Analysis - Reducing risk - 9/11 Attacks - Chernobyl disaster - Bhopal gas tragedy - Chennai building collapse (2014) - Case studies - Introduction to Environmental Impact Assessment.	09
	GLOBAL ISSUES IN ENGINEERING	
V	Multinational Corporations - Environmental Ethics - Conflict Management - Economic recession - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Code of Conduct - Corporate Social Responsibility - Introduction to value engineering	09
	Total Instructional Hours	45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
1. Integrate professional ethics and human values in their work environment
 2. Interpret the social experimentation techniques and contract laws in engineering
 3. Recognize and enforce their professional rights and responsibilities in the field of engineering
 4. Assess the risks in an engineering project and propose suitable safety measures
 5. Identify the global issues in engineering and the need for corporate social responsibilities

TEXT BOOKS:

- T1- Mike Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 4th Edition, 2014
- T2-Nikita Agarawal, Rishi Kumar, "Laws for Engineers", Genus Publications, 2016

REFERENCE BOOKS:

- R1-Jayshree suresh, B.S.Raghavan,"Human Values and Professional Ethics," S.Chand&company Ltd, New Delhi, 2th Edition, 2007.
- R2-Edmund G See Bauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
- R3-Abrahamson M.V, "Engineering Law and the I.C.E Contracts, 4th Edition, 2016
- R4-Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", LexisNexis Butterworths, Fourth edition, 2000



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**Dean (Academics)
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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6301	BUILDING SERVICES	3	0	0	3

- Course Objective**
- To study the various electrical systems and components in building construction
 - To have exposure on principles of illumination and lighting design
 - To impart knowledge on the various methods of ventilation systems and air-conditioning facilities
 - To emphasize the need for fire safety in buildings
 - To gain knowledge on importance of 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 – Planning electrical wiring for building – Main and Distribution boards – Transformers and switch gears - Layout of substations	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 – Lams 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	9
	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	9
	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

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

CO1: Illustrate and design the electrical supply systems, systems of wiring and protective electrical installations included in buildings

CO2: Identify and incorporate the concepts of illumination and its principles while designing the lighting system of a building

CO3: Understand the principles of ventilation and air conditioning in the design of buildings

CO4: Compare the various fire safety systems and devices

CO5: Gain knowledge on 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, 2015.
T2 - Steffy, G., "Architectural Lighting Design", John Wiley and Sons, 2008.

REFERENCE BOOKS:

- R1 - National Building Code of India, NBC, 2016.
R2 - Uniform Plumbing Code of India, IAPMO, 2018.
R3 - Arora, C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 2017.
R4 -Curd,E. F. and Howard, C. A., "Introduction to Building services", Palgrave Macmillan, UK, 1996.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6302	AIRPORTS, DOCKS AND HARBOUR ENGINEERING	3	0	0	3

- Course Objective**
1. To understand the components of aircraft and stipulations of airport site selection.
 2. To gain knowledge on layout and location of airport buildings.
 3. To get exposed to the design principles of runway and taxiway.
 4. To learn the components of docks & harbour and its design principles.
 5. To gain an insight 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	9
AIRPORT DESIGN		
III	Runway Design: Orientation, Wind Rose Diagram – Runway Length – Basic and Actual Length Problems – Geometric Design of Runways, Configuration and Pavement Design Principles – Elements of Taxiway Design – Runway and Taxiway Markings and Lighting	9
DOCKS AND HARBOUR		
IV	Definition of Terms – Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth - Requirements and Classification of Harbours & Docks – Site Selection, Layout and Investigation – Speed of Water, Range of Tides, Waves and Tidal Currents, Anchoring Grounds, Geological Characteristics	9
COASTAL STRUCTURES		
V	Coastal Structures: Breakwaters, Piers, Wharves, Jetties, Quays, Dolphins and Fenders Navigational Aids and Dredging: Navigational Aids and Mooring Accessories, Dredging - Methods. Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone	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: Illustrate the various components and zones of an airport layout
 - CO3: Interpret the design principles of Runway and Taxiway
 - CO4: Differentiate the various components of docks and Harbour
 - 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 Pvt. Ltd., Gujarat, 17th Edition, 2018.
R2 - Oza H. P. & Oza G. H. “Dock and Harbour Engineering”, Charotar Publishing House Pvt. Ltd., Gujarat, 2016.
R3 - Khanna, S.K. Arora, M.G and Jain, S.S, Airport Planning and Design, Nemchand and Bros, Roorkee, 1999.
R4 - Subramanian, K.P., “Highways, Railways, Airport and Harbour Engineering”, Scitech Publications (India), Chennai, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6303	SUBSURFACE INVESTIGATION AND FIELD TESTING	3	0	0	3

Course Objective
1. To gain knowledge on exploration and geophysical methods
2. To learn the various exploration techniques
3. To understand the various sampling techniques
4. To study the field tests in soil exploration
5. To acquire knowledge on the various instruments in soil engineering

Unit	Description	Instructional Hours
PLANNING OF EXPLORATION AND GEOPHYSICAL METHODS		
I	Scope and objectives, planning an exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole -down hole methods	9
EXPLORATION TECHNIQUES		
II	Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs	9
SOIL SAMPLING		
III	Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling - advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples	9
FIELD TESTS IN SOIL EXPLORATION		
IV	Field tests, penetration tests, Field vane shear, Insitu shear and bore hole shear test, pressuremeter test, dilatometer test - plate load test–monotonic and cyclic; field permeability tests – block vibration test- Procedure, limitations, correction and data interpretation of all methods.	9
INSTRUMENTATION		
V	Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements - slope indicators, sensing units, case studies.	9
Total Instructional Hours		45

Course Outcome
Upon successful completion of the course, students will have ability to
CO1: Select the suitable method of exploration and geophysical methods
CO2: Understand various exploration techniques
CO3: Comprehend the various sampling techniques
CO4: Interpret the various field tests in soil exploration
CO5: Interpret the principles applications of various instruments in soil engineering

TEXT BOOKS:

- T1 - Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2017.
T2 - Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors Ltd., New Delhi, 2018.

REFERENCE BOOKS:

- R1 – Hunt, R.E., "Geotechnical Engineering Investigation Manual", McGraw Hill, New York, 2005.
R2 - Winterkorn, H.F. and Fang, H.Y., "Foundation Engineering Hand Book", Van Nostrand Reinhold, New York, 2010.
R3 - Alam Singh and Chowdhary, G.R., "Soil Engineering in Theory and Practice", Volume-2, CBS Publishers and Distributors, New Delhi, 2019.
R4 – Mair, R.J. and Wood, D.M., "Pressuremeter Testing Methods and Interpretation", CBS Publishers and Distributors, New Delhi, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6304	GROUNDWATER ENGINEERING	3	0	0	3

- Course Objective**
1. To understand various hydrogeological parameters and GEC norms
 2. To learn the concepts of well hydraulics and groundwater governing equations
 3. To gain knowledge on groundwater modelling and management
 4. To acquire knowledge on groundwater quality and its significance on health and environment
 5. To explore the techniques involved in groundwater conservation

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 – GEC norms - Steady state flow - Darcy’s law - Groundwater velocity – DupuitForchheimer assumption – Steady radial flow into a well	9
	WELL HYDRAULICS	
II	Unsteady state flow - Theis method - Jacob method – Chow’s method – Law of Times – Theis recovery – Bailer method – Slug method - Tests - Image well theory – Partial penetrations of wells – Well losses – Specific capacity -and safe yield - Collector well and infiltration gallery	9
	GROUNDWATER MODELLING	
III	Need for management model – Database for groundwater management – Groundwater balance study – Introduction to physical and mathematical models – Model conceptualization – Initial and boundary condition – Calibration – Validation – Future prediction – Sensitivity analysis – Uncertainty – Development of a model	9
	GROUND WATER QUALITY	
IV	Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water – Industrial water – Irrigation water - Ground water Pollution and legislation - Environmental regulatory requirements - Control of Ground Water Pollution Hazards – Evaluation of Pollution hazard and water supply pollution hazards – Strategies for control of Ground water pollution.	9
	GROUNDWATER CONSERVATION	
V	Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) - Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes	9
	Total Instructional Hours	45

Course Outcome

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

CO1: Interpret the various hydro-geological parameters and GEC norms
CO2: Estimate the yield of groundwater from a source based on the data given
CO3: Elustrate the various physical and mathematical models of groundwater management
CO4: Understand the importance of groundwater quality and its environmental concerns
CO5: Compare and contrast the various recharge techniques for groundwater conservation

TEXT BOOKS:

- T1 - Raghunath H.M., “Ground water Hydrology”, New Age International (P) Ltd., 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, 2018.
R2 - Karanth K.R, “Ground Water Assessment Development and Management” Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
R3 - Bear J., “Hydraulics of Groundwater”, McGraw-Hill India, 2014.
R4 - Cushman J.H., Tartakovsky D.M., “The Handbook of Groundwater Engineering”, Taylor & Francis International, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6305	ARCHITECTURE AND TOWN PLANNING	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 - Introduction to Ancient and Medieval time of architectures.	9
SITE PLANNING AND LAYOUT DESIGN		
II	Surveys – Necessity- Types of Survey and Site analysis – Development Control – Tools - Layout regulations- Layout design concepts- Principles -Advantages and disadvantages of layout design concept.	9
ANTHROPOMETRY AND SPACE STANDARDS		
III	Classification of residential, institutional, commercial and industrial buildings – Application of anthropometry and space standards - Inter relationships of functions – Safety standards – Building rules and regulations – Integration of building services – Interior design.	9
CLIMATE AND ENVIRONMENT 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.	9
TOWN PLANNING AND LANDSCAPING		
V	Planning – Definition, concepts and processes- Urban planning standards and zoning regulations- Urban renewal – Conservation – Principles of Landscape design - 3D Approach – Landscape Maintenance.	9
Total Instructional Hours		45

Course Outcome

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

CO1: Acknowledge the basic elements and principles of design in architecture
CO2: Apply the layout design concepts and regulations while designing a building
CO3: Integrate the principles of anthropometry, safety standards and basic building services in building design
CO4: Incorporate the climatic design principles and green building concepts in building design
CO5: Consider the principles of town planning; zoning regulations and landscaping while planning a building

TEXT BOOK

- T1 - Francis D.K. Ching, "Architecture: Form, Space and Order", John Wiley & Sons, 2014.
T2 - MuthuShoba Mohan, "Principles of Architecture", Oxford University Press, New Delhi, 2010.

REFERENCE BOOK

- R1 - Daniel A. Barber, "Modern Architecture and Climate: Design Before Air Conditioning", Princeton University Press, New Jersey, 2020.
R2 – Aravind Krishnan, Nick Baker, Simos Yannas, Steve Szokolay, "Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings", McGraw Hill Education, New York, 2017.
R3 - "National Building Code of India", Vol 1 & 2, Bureau of Indian Standards, New Delhi, 2016.
R4- Jain A. K., "Town Planning – Principles, Process and Practice", Khanna Publishing House, New Delhi, 2020.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6306	DISASTER PREPAREDNESS AND PLANNING	3	0	0	3

- Course Objective**
- To study characteristics of disasters
 - To explore the primary approaches to disaster risk reduction
 - To learn the various advanced disasters and development management
 - To understand the components of disaster risk management in india
 - To give exposure on common applications of disaster management

Unit	Description	Instructional Hours
	INTRODUCTION TO DISASTERS	
I	Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.	09
	APPROACHES TO DISASTER RISK REDUCTION (DRR)	
II	Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.	09
	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	
III	Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.	09
	DISASTER RISK MANAGEMENT IN INDIA	
IV	Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.	09
	DISASTER MANAGEMENT: APPLICATIONS, CASE STUDIES AND FIELD WORKS	
V	Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.	09
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- Comprehend and understand the types of disasters
 - Handle the planning and design of various disaster risk reduction
 - Identify and incorporate the safety practices disasters and development
 - Gain knowledge on disaster risk management in India
 - Illustrate the various components disaster management

TEXT BOOKS:

- T1 - Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
T2 - Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

REFERENCE BOOKS:

- R1 - Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
R2 – Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.
R3 - Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
R4 - Government of India, National Disaster Management Policy, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CE6401	REMOTE SENSING AND GIS	3	0	0	3

- Course Objective**
1. To understand the basic principles and components of Remote Sensing
 2. To learn the characteristics and processing techniques of remote sensing imagery.
 3. To gain knowledge on the various data and database systems involved in GIS
 4. To get exposed to the various processes related to data analysis and modeling in GIS
 5. To study the applications of remote sensing and GIS

Unit	Description	Instructional Hours
	REMOTE SENSING	
I	Definition and its components - History of remote sensing and Indian Space Program. Electromagnetic spectrum - wavelength regions important to remote sensing - Wave theory, Particle theory, Stefan-Boltzman Law - Atmospheric scattering, absorption - Atmospheric windows – spectralreflectance of EMR with earth surface, water, vegetation and soil- spectral signature concepts - Platform and Sensors.	9
	IMAGE INTERPRETATION AND ANALYSIS	
II	Types of Data Products - Types of image interpretation - Basic elements of image interpretation - Visual interpretation keys - Digital Image Processing - Pre-processing - Image enhancement techniques - Multispectral Image classification - Supervised and unsupervised	9
	GEOGRAPHICAL INFORMATION SYSTEM AND ITS ANALYSIS	
III	Maps - Map projections - Types of map projections- GIS definition - Basic components of GIS - Data type - Spatial and non-spatial data - Database concepts - Vector and Raster data structures, Data compression, Edge matching	9
	DATA INPUT EDITING AND ANALYSIS	
IV	Data stream - Input methods - GPS for data capture – Editing- Data Retrieval - Query - Simple Analysis - Spatial Analysis - Overlay - Vector Data Analysis - Raster Data Analysis- Topological analysis - Modeling surfaces - DEM -DTM - Slope Model - Integration of Remote Sensing and GIS	9
	REMOTE SENSING AND GIS APPLICATIONS	
V	Applications- Land use - Water Resources and Watershed management - Irrigation and Agriculture - Environmental studies - ground water exploration - Defense Application - Wasteland Management - Weather Forecast - Flood and Storm Routing - Emergency Management and Real Estate.	9
Total Instructional Hours		45

Course Outcome

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

CO1: Illustrate the principles of remote sensing and its components

CO2: Compare and interpret the characteristics and processing techniques of remote sensing imagery

CO3: Classify the various types of data and database systems involved in GIS

CO4: Comprehend the various processes related to data analysis and modeling in GIS

CO5: Understand the applications of remote sensing and GIS in various field of engineering

TEXT BOOKS:

T1 - Anji Reddy, M., "Remote Sensing and Geographical Information Systems", Fourth Edition, B S Publications, India, 2019.

T2 - Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, "Remote Sensing and Image Interpretation", Seventh Edition, John Wiley and Sons Inc. New York, 2015.


REFERENCE BOOKS:

R1 – Swain P. H. and Davis, S.M., "Remote Sensing: The Quantitative Approach", McGraw Hill Higher Education, 1979.

R2 – Kumar S. "Basics of Remote Sensing and GIS" Laxmi Publications, 2017.

R3 – Dale A. Quattorachi, Elizabeth Wentz "Integrating Scale in Remote Sensing and GIS" CRC Publications, 2019.

R4 - Kali CharanSahu "Textbook of Remote Sensing and Geographical Information Systems" Atlantic Publishers & Distributors Pvt. Limited, 2020.


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SYLLABUS



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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7201	ESTIMATION, COSTING AND VALUATION ENGINEERING	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 Proofer – 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**
- To learn the methods of irrigation and understand the factors influencing their efficiencies.
 - To study the components and types of diversion headworks.
 - To gain knowledge on the design procedure for a gravity dam.
 - To learn the various types of dams, their components and failure mechanisms.
 - 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 Practice New Age International (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**
- To learn the basics of various dynamic forces and the response of structures to it.
 - To study the mode shapes of the structure under dynamic loading
 - To learn the elements of seismology and understand the guidelines for earthquake resistant design.
 - To study the behavior of the structure in response to earthquakes and the importance of ductility in earthquake resistant design.
 - 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 structures
 - CO5: Identify and incorporate the various techniques used 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- Hal

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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
	INTRODUCTION	
I	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
	DISPERSION OF POLLUTANTS	
II	Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric Stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.	9
	AIR POLLUTION CONTROL	
III	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
	AIR QUALITY MANAGEMENT	
IV	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
	INDOOR AIR QUALITY AND NOISE POLLUTION	
V	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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2022 - 2023

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

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

Unit	Description	Instructional Hours
	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
I	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
II	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
III	OFF-SITE PROCESSING Objectives of waste processing - Processing techniques and Equipment–Resource recovery from solid wastes–Composting – Incineration – Pyrolysis–Options under Indian conditions	9
IV	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
V	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 – I 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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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	Use of modern materials and their impact on disaster reduction, Use of modern analysis, design and construction techniques optimisation for performance.	9
	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**
- To make students understand the design philosophies and types of materials to be used for tall buildings.
 - To incorporate the design method of applying loads as per codal provisions.
 - To get exposed to various structural systems and its behaviour.
 - To inculcate various methods to analyze and design the structural elements.
 - 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 Wiley and 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 isoparametric 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 – imposition 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 – Lagrangean 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
	GENERAL PRINCIPLES OF FABRICATION	
I	Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication - Economy of prefabrication – Modular coordination – Standardization –	9
	Planning for Components of prefabricated structures –Disuniting of structures – Handling and erection stresses –Elimination of erection stresses – Beams, columns - Symmetrical frames.	
	PREFABRICATED ELEMENTS	
II	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
	JOINTS IN STRUCTURAL MEMBERS	
III	Joints for different structural connections – Dimensions and detailing– Design of expansion joints.	9
	DESIGN OF PRE FABRICATED UNITS	
IV	Prefabricated units for Industrial structures, Multi-storied buildings and Water tanks etc., Application of pre stressed concrete in prefabrication.	9
	PRODUCTION TECHNOLOGY	
V	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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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 on the 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, 2009.

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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 towers and 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 shell units, 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 Distributors 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, Guniting, 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 - Amamath C. Devdas Menon, Amlan Kumar S, Hand book on Seismic Retrofit of Buildings, Alpha Science International Limited, 2008.

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2016-2017
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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**
- To understand the fundamentals of valuation.
 - To study the characteristics of land and the various theories of land valuation.
 - To learn the different methods of valuation of immovable properties
 - To explore the various techniques of building valuation
 - 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 flow technique – 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 Publishing Co., 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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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8306	GROUNDWATER ENGINEERING	3	0	0	3

- Course Objective**
- To study the various hydrogeological parameters.
 - To enhance the knowledge on well hydraulics
 - To understand the origin, movement and quality of groundwater.
 - To learn the need and development of models for groundwater management.
 - 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 the economic 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
CLASSIFICATION AND INDEX PROPERTIES OF ROCKS		
I	Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.	9
ROCK STRENGTH AND FAILURE CRITERIA		
II	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
INITIAL STRESSES AND THEIR MEASUREMENTS		
III	Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – technique for measurements of in-situ stresses.	9
APPLICATION OF ROCK MECHANICS IN ENGINEERING		
IV	Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.	9
ROCK BOLTING		
V	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 to
	CO1 – 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 - Vibrofloatation - 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, 2004.

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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 federal policies.
 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 to insufficient 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 and compare the existing energy codes with green building codes and rating systems.
 - CO5. Recognize and demonstrate methods for green remodeling and management and green rating system 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.

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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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited with 'A' Grade by NAAC, Accredited by NBA (ECE, MECH, EEE, IT & CSE)
Coimbatore - 641 032



DEPARTMENT OF CIVIL ENGINEERING

REGULATION - 2016

For the students studying in the academic year 2021 – 2022

21HE1101 - TECHNICAL ENGLISH

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21MA1102 CALCULUS AND LINEAR ALGEBRA

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21PH1151 APPLIED PHYSICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	1.3	-	-	-	-	-	1	2.4	2.4


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21CY1151 CHEMISTRY FOR ENGINEERS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21CS1151 PROBLEM SOLVING AND PYTHON PROGRAMMING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21ME1152 ENGINEERING DRAWING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21HE1001 LANGUAGE COMPETENCY ENHANCEMENT COURSE- I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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21HE1072 Career Guidance – Level I Personality, Aptitude and Career Development

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21HE1073 ENTREPRENEURSHIP AND INNOVATION

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21HE2101 BUSINESS ENGLISH FOR ENGINEERS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21MA2101 DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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21EE2103 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	3	2.5	2.0	2	1	3	2	1	-	-	-	1.4	2.6	1.8

21ME2101 ENGINEERING MECHANICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21PH2151 MATERIAL SCIENCE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21CY2151 ENVIRONMENTAL STUDIES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	-	-

M.L.L.
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21ME2001 ENGINEERING PRACTICES

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

21HE2071 LANGUAGE COMPETENCY ENHANCEMENT COURSE- II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

21HE2072 Course title Career Guidance – Level II Personality, Aptitude and Career Development

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

19MA3103 FOURIER ANALYSIS AND NUMERICAL METHODS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

M.U.
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 CIVIL - HICET**



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19CE3201 MECHANICS OF FLUIDS

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

19CE3202 GEOLOGY AND CONSTRUCTION MATERIALS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	2	2	1				2	2	2
CO2	3	1	1	1	1	1	1					2	1	1
CO3	3	1	1	1	1	1	1					2	2	2
CO4	3	1	1	2	1	2	2	2				3	2	2
CO5	3	1	1	1	1	1	2	2				3	2	2
Average	3	1.2	1	1.4	1	1.4	1.6	1.6	-	-	-	2.4	1.8	1.8

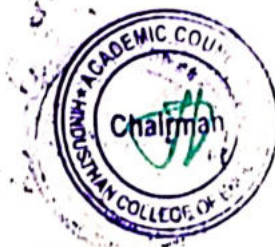
19CE3203 SURVEYING

	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

19CE3251 MECHANICS OF SOLIDS

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

M.L.L.
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 CIVIL - HICET**



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19CE3001 SURVEY LAB

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

19CE3002 COMPUTER AIDED BUILDING DRAWING

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

19MC3191 INDIAN CONSTITUTION

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

19MA4103 PROBABILITY AND STATISTICS

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

M. S.
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CIVIL - HICET



Dean Academic,
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19CE4201 STRENGTH OF MATERIALS

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

19CE4202 APPLIED HYDRAULICS AND HYDRAULIC MACHINERY

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

19CE4203 SOIL MECHANICS

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

19CE4251 CONCRETE TECHNOLOGY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1	3	1	2		1	1	2	1		3	3
CO2	3		1	1		1		1	1	2	1		3	3
CO3	3	3	3	3				3	2	3	2	1	3	3
CO4	3		1	3	1	2		2	3	2	2		3	3
CO5	3		2	2	1	2	3	1	2	2	1	2	3	3
Average	3	3	1.6	2.4	1	1.75	3	1.6	1.8	2.2	1.4	1.5	3	3

M.L.I.
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19CE4001 SOIL MECHANICS LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		1	3		2	3	2	3		2	3	
CO2	3		1	3	2		2	3	1	2	1	3	3	2
CO3	2	3				2	1			1		2	2	
CO4	3	3	1		2	1	1	2	2	1	3	1	3	3
CO5	3	3		3	2	2			1	2	1	2	1	1
Average	2.8	3	1	2.3	2.25	1.6	1.5	2.6	1.5	1.8	1.6	2	2.4	2

19CE4002 FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

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

19MC4191 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

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

19CE5201 STRUCTURAL ANALYSIS I

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

M.L.L
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 CIVIL - HICET**



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19CE5202 DESIGN OF RC ELEMENTS

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

19CE5203 WATER SUPPLY ENGINEERING

	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

19CE5204 FOUNDATION ENGINEERING

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

19CE5205 HIGHWAY AND RAILWAY ENGINEERING

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

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19CE5001 CONCRETE AND HIGHWAY ENGINEERING LAB

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

19CE5002 SURVEY CAMP

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

19HE5071 SOFT SKILLS – I

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

19HE5072 DESIGN THINKING

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

U.I.
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 CIVIL - HICET**



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19CE6201 STRUCTURAL ANALYSIS II

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

19CE6202 DESIGN OF STEEL STRUCTURAL ELEMENTS

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

19CE6203 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

19CE6204 CONSTRUCTION MANAGEMENT

	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

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 CIVIL - HICET**



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19CE6001 WATER AND WASTEWATER TESTING LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	1		2	1		2		1	2	1	3
CO2	3	2	3	2	1	2	2	1	1	1	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	1	2	3	2	3
CO5	3	1	3	3	2	3	3	2	2	2	1	3	2	3
Average	3	2	3	2.4	2	2.6	2.4	1.5	1.6	1.25	1.4	2.4	1.6	3

19CE6002 DESIGN AND DRAWING OF RC STRUCTURES

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

19HE6071 SOFT SKILLS – II

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

19HE6072 INTELLECTUAL PROPERTY RIGHTS (IPR)

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

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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

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

19CE5301 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

M.L.L
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 CIVIL - HICET**



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19CE5302 TRAFFIC ENGINEERING

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

19CE5303 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
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

19CE5304 CONSTRUCTION TECHNIQUES, EQUIPMENT AND SAFETY

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

19CE5305 HYDROLOGY

	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
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

M.C.
Chairman - BoS
CIVIL - HICET



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Dean (Academics)
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19CE5306 PROFESSIONAL ETHICS AND LAWS FOR CIVIL ENGINEERS

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

19CE6301 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

19CE6302 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

19CE6303 SUBSURFACE INVESTIGATION AND FIELD TESTING

	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

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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
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

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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
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

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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

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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
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 - BUILDINGSERVICES

	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

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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

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