HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY,

COIMBATORE 641 032

(An Autonomous Institution Affiliated to Anna University, Chennai)

VISION OF THE INSTITUTE
To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values

MISSION OF THE INSTITUTE
• To provide academic excellence in technical education through novel teaching methods. • To empower students with creative skills and leadership qualities • To produce dedicated professionals with social responsibility

VISION OF THE DEPARTMENT
To be recognized globally for pre-eminence in Civil Engineering education, research and service

MISSION OF THE DEPARTMENT
• To produce well-informed graduates with scientific and technical knowledge and excellent engineering skills for professional practice, advanced study and research. • To inculcate professional and ethical responsibilities related to industry, society and environment. • To interact with industries and address issues related to infrastructure, public health and environmental protection for sustainable development.

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PROGRAMME EDUCATIONAL OBJECTIVES

To produce graduates with the ability to

- Excel as practicing engineers, academicians and researchers
- Play a vital role in the nation's infrastructural and sustainable development
- Hold professional and ethical responsibilities as engineers, consultants, entrepreneurs and pioneers while addressing the challenges of the society

PROGRAMME OUTCOMES

a) Engineering Knowledge: Apply the knowledge of Mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.

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

c) Design/development of solutions: Design solutions for complex civil 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.

d) 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.

e) 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.

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f) 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 civil engineering practice.

g) Environment and sustainability: understand the impact of the professional civil engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

j) Communication: communicate effectively on complex civil 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.

k) 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 civil engineering projects and in multidisciplinary environments.

l) Lifelong 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.

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PROGRAMME SPECIFIC OUTCOMES
The graduates will be able to: • Apply their engineering knowledge, communication skills, professional and ethical principles to solve problems in civil engineering and contribute to the infrastructural development in a sustainable way • Use their engineering background to excel in competitive exams for advanced study, research and professional career

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DEPARTMENT OF CIVIL ENGINEERING

SALIENT FEATURES OF SYLLABUS

1. Survey camp is conducted for a period of two weeks during the fourth semester summer vacation to enable the students to have a better understanding of field practices.
2. Implant training for a period of at least 4 weeks has been made mandatory for all the students to gain a real time experience to construction methods and practices.
3. Structural analysis and design using computer applications (STAAD.Pro and ANSYS) has been incorporated in the syllabus to meet the demands of the industry.
4. A separate course on “Valuation of Buildings” has been added as an elective course in the syllabus as per the recommendations of the industry experts
5. Students have the opportunity to opt for open electives offered by various departments to pursue a course of their own interest to develop inter departmental engineering skills.

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REGULATION – 2016

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

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA1101	Engineering Mathematics-I	3	2	0	4	25	75	100
2	16PH1101	Engineering Physics	3	0	0	3	25	75	100
3	16CY1101	Engineering Chemistry	3	0	0	3	25	75	100
4	16HE1101R	Essential English for Engineers – I	3	2	0	4	50	50	100
5	16GE1103	Problem Solving and Python Programming	3	0	0	3	25	75	100
6	16GE1102	Engineering Graphics	2	0	4	4	25	75	100
PRACTICAL									
7	16PS1001	Physical Sciences Lab - I	0	0	2	1	50	50	100
8	16GE1004	Problem Solving and Python Programming Lab	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Lab	0	0	4	2	50	50	100
10	16GE1003	Value Added Course I : Language Competency Enhancement Course-I	0	0	0	1	-	100	100
		Total :	**17**	**4**	**14**	**27**			**1000**

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA2102	Engineering Mathematics-II	3	2	0	4	25	75	100
2	16PH2102	Physics of Materials	3	0	0	3	25	75	100
3	16CY2103	Chemistry for Civil Engineering	3	0	0	3	25	75	100
4	16HE2102R	Essential English for Engineers - II	3	2	0	4	50	50	100
5	16GE2101	Engineering Mechanics	3	2	0	4	25	75	100
6	16EE2202	Basics of Electrical and Electronics Engineering	3	0	0	3	25	75	100
PRACTICAL									
7	16PS2001	Physical Sciences Lab - II	0	0	2	1	50	50	100
8	16CE2001	Computer Aided Drawing Lab	0	0	4	2	50	50	100
9	16GE2001	Value Added Course II : Language Competency Enhancement Course-II	0	0	0	1	-	100	100
		Total :	**18**	**6**	**6**	**25**			**1000**

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SEMESTER III

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

SEMESTER IV

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

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SEMESTER V

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

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

SEMESTER VI

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

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SEMESTER VII

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

***Training of fourweeks has to be undergone by the student from thirdsemester vacation to sixth semester vacation.**

SEMESTER VIII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CE8201	Structural Dynamics and Earthquake Engineering	3	0	0	3	25	75	100
2	16CE83XX	Professional Elective V	3	0	0	3	25	75	100
3	16CE83XX	Professional Elective VI	3	0	0	3	25	75	100
PRACTICAL									
4	16CE8901	Project Work	0	0	16	8	100	100	200
		Total :	**9**	**0**	**16**	**17**			**500**

Total No. of Credits: 187

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LIST OF ELECTIVES

PROFESSIONAL ELECTIVE – I

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

PROFESSIONAL ELECTIVE – II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CE6301	Architecture	3	0	0	3	25	75	100
2	16CE6302	Interior Design	3	0	0	3	25	75	100
3	16CE6303	Urban Planning and Development	3	0	0	3	25	75	100
4	16CE6304	Housing Planning and Management	3	0	0	3	25	75	100
5	16CE6305	Engineering Economics and Cost Analysis	3	0	0	3	25	75	100

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PROFESSIONAL ELECTIVE – III

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

PROFESSIONAL ELECTIVE – IV

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

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PROFESSIONAL ELECTIVE – V

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CE8301	Computer Aided Design of Structures	3	0	0	3	25	75	100
2	16CE8302	Design of Industrial Structures	3	0	0	3	25	75	100
3	16CE8303	Design of Prestressed Concrete Structures	3	0	0	3	25	75	100
4	16CE8304	Repair and Rehabilitation of Structures	3	0	0	3	25	75	100
5	16CE8305	Valuation of Land and Buildings	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE – VI

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

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OPEN ELECTIVES

THEORY

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
AERONAUTICAL ENGINEERING									
1	16AE6401	Introduction to Flight	3	0	0	3	25	75	100
2	16AE7402	Industrial Aerodynamics	3	0	0	3	25	75	100
AUTOMOBILE ENGINEERING									
1	16AU6401	Basis of Automobile Engineering	3	0	0	3	25	75	100
2	16AU7401	Automotive Safety	3	0	0	3	25	75	100
CIVIL ENGINEERING									
1	16CE6401	Building Services	3	0	0	3	25	75	100
2	16CE7402	Strategies of Green Buildings	3	0	0	3	25	75	100
COMPUTER SCIENCE AND ENGINEERING									
1	16CS6401	Soft Computing	3	0	0	3	25	75	100
2	16CS6402	Optimization Techniques	3	0	0	3	25	75	100
ELECTRONICS AND COMMUNICATION ENGINEERING									
1	16EC6401	Consumer Electronics	3	0	0	3	25	75	100
2	16EC7402	Internet Of Things	3	0	0	3	25	75	100
ELECTRONICS AND INSTRUMENTATION ENGINEERING									
1	16EI6401	Neural Networks and Fuzzy Systems	3	0	0	3	25	75	100
2	16EI7402	Electrical Energy Management	3	0	0	3	25	75	100
ELECTRICAL AND ELECTRONICS ENGINEERING									
1	16EE6401	Industrial Automation – PLC and SCADA	3	0	0	3	25	75	100
2	16EE7402	LabVIEW for Engineering Applications	3	0	0	3	25	75	100

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INFORMATION TECHNOLOGY									
1	16IT6401	Cyber Security and Forensics	3	0	0	3	25	75	100
2	16IT7402	Artificial Intelligence	3	0	0	3	25	75	100
MECHANICAL ENGINEERING									
1	16ME7402	Composite Materials for Engineering	3	0	0	3	25	75	100
2	16ME6401	Rapid Prototyping and Lean Manufacturing	3	0	0	3	25	75	100
MECHATRONICS ENGINEERING									
1	16MT7402	Hybrid Vehicles System	3	0	0	3	25	75	100
2	16MT6401	Industrial Safety and Environment	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA1101	ENGINEERING MATHEMATICS - I (Common to all Branches)	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Find curvature, evolutes and envelopes using the concept of differentiation.
3. Solve ordinary differential equations of certain types using Wronskian technique.
4. Familiarize the functions of several variables which are needed in many branches of engineering.
5. Understand the concept of double and triple integrals.

Unit	Description	Instructional Hours
I	**MATRICES** Eigen valuesand Eigen vectorsofarealmatrix– PropertiesofEigen values andEigen vectors (withoutproof)–Cayley-Hamilton Theorem (excluding proof)– Orthogonal matrices– Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**DIFFERENTIAL CALCULUS** Curvature in Cartesian co-ordinates – Radius and Centre of curvature - Circle of curvature – Involutes and Evolutes(parabola, ellipse, cycloid, asteroid) – Envelopes - single parameter and two parameter family of curves.	12
III	**ORDINARYDIFFERENTIALEQUATIONS** Second and higher order linear differential equations with constant coefficients and with RHS of the form e^{ax} , x^n, sinax or cosax , $e^{ax}f(x)$ and $xf(x)$ where $f(x)$ is sinbx or cosbx– Method of variation of parameters – Linear differential equations with variable coefficients (Euler's equation)	12
IV	**FUNCTIONS OF SEVERAL VARIABLES** Totaldifferentiation (excluding implicit functions) - Partial derivatives of composite functions - Taylor'sseries for functions of two variables- Maximaandminimaof functions oftwovariables - Lagrange's method of undeterminedmultipliers – Jacobians.	12
V	**MULTIPLEINTEGRALS** DoubleintegralsinCartesiancoordinates–Changeoforderofintegration–Area enclosed by the plane curves (excluding surface area)– Tripleintegrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: 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
CO2: Apply the concept of differentiation to find the radius, centre and circle of curvature of any curve
CO3: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems
CO4: Identify the maximum and minimum values of surfaces.
CO5: Computation of area of a region in simpler way by changing the order of integration and evaluation of triple integrals to compute volume of three dimensional solid structures.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2- Veerarajan T, "Engineering Mathematics–I", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS :

R1-BaliN.P &ManishGoyal,"ATextbookofEngineeringMathematics",8th Edition, Laxmi Pub.Pvt. Ltd. 2011.
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.
R4-Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol I, Second Edition, Pearson publishing, 2011.
R5- Wylie &Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH1101	ENGINEERING PHYSICS (Common to all Branches)	3	0	0	3

Course Objective

1. Illustrate the fundamental knowledge inmechanical properties of matter and thermal physics.
2. Gain knowledge about laser and their applications.
3. Conversant with principles of optical fiber, types and applications of optical fiber.
4. Discuss the architectural acoustics and applications of Ultrasonics.
5. Extend dual nature of matter and the Necessity of quantum mechanics to explore the behavior of sub atomic particles.

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER AND THERMAL PHYSICS** Elasticity – Hooke's law – Stress-strain diagram - Relation between three modulii of elasticity (qualitative) — Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending – I-shaped girder. Modes of heat transfer – Thermal conductivity – Newton's law of cooling - Lee's disc method - Conduction through compound media (series and parallel).	9
II	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO2 laser, Semiconductor lasers:(homojunction and heterojunction) – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.	9
III	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication link –Fiber optic sensors – Temperature and displacement sensors.	9
IV	**ACOUSTICS AND ULTRASONICS** Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo system.	9
V	**QUANTUM PHYSICS AND APPLICATIONS** Black body radiation – Planck's theory (derivation) –Compton effect experimental verification only - Matter waves – Physical significance of wave function – Schroedinger's wave equations – Time independent and time dependent wave equations –Particle in a box (One dimensional) – Scanning electron microscope – Transmission electron microscope.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics.
CO2: Uunderstand the advanced technology of LASER in the field of Engineering and medicine.
CO3: Exposed the fundamental knowledge of Optical fiber in the field of communication Engineering.
CO4: Understand the production of ultrasonics and its applications in NDT.
CO5: Impart the fundamental knowledge on Quantum Physics.

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, DhanpatRai Publications (P) Ltd., New Delhi,2013.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2010
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and CompanyLtd., New Delhi,2014
R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2013

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16CY1101	ENGINEERING CHEMISTRY (Common to all Branches)	3	0	0	3

Course Objective

1. The student should be conversant with boiler feed water requirements, related problems and water treatment techniques.
2. The student should be conversant with the principles of polymer chemistry and engineering applications of polymers and composites
3. The student should be conversant with the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
4. To acquaint the student with important concepts of spectroscopy and its applications.
5. To acquaint the students with the basics of nano materials, their properties and applications

Unit	Description	Instructional Hours
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, calculations, estimation of hardness of water – EDTA method - scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; Conditioning methods of hard water – External conditioning - demineralization process- Internal conditioning - domestic water treatment: screening, sedimentation, coagulation, filtration, disinfection – chlorine – UV method; desalination: definition, reverse osmosis.	9
II	**POLYMER & COMPOSITES** 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, Teflon – moulding of plastics (extrusion and compression); rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.	9
III	**ENERGY SOURCES AND STORAGE DEVICES** 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- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	9
IV	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – interferences - estimation of nickel by atomic absorption spectroscopy.	9
V	**NANOMATERIALS** Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Illustration of the basic parameters of water, different water softening processes and effect of hard water in industries.
CO2:Knowledge on basic properties and application of various polymers and composites as an engineering material.
CO3:Summarize the various energy sources and energy storage devices
CO4:Analyze various analytical skills in handling various machines, instruments, apart from understanding the mechanism involved.
CO5:Describe the basic properties and application of nanomaterials.

TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi (2015).
T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

R1 - B.Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
R2 - B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2005).
R3 - S.S.Dara “A Text book of Engineering Chemistry” S.Chand&Co.Ltd., New Delhi (2010).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	16HE1101R	ESSENTIAL ENGLISH FOR ENGINEERS - I (Common to all Branches)	3	2	0	4

Course Objective

1. It fulfills the necessary skills needed in today's global workplaces.
2. Student will be able to interpret and illustrate formal communication.
3. It empowers students in choosing right lexical techniques for effective presentation
4. It equips the learner to analyze and list out things in logical order
5. The learner develops the ability to create and integrate ideas in a professional way.

Unit	Description	Instructional Hours
I	Getting to know people – Introduction – Talking about jobs (Present Simple) – Talking about working conditions(Adverb of Frequency) - Talking about company history and structure (Past simple, Prepositions of Time) – Talking about company activities (Connectors of addition and contrast, Present Continuous) – Focus on language – Parts of Speech – Gerund and Infinitives – Instruction-**General Vocabulary**.	12
II	Vocabulary practice – (Telephoning Leaving and taking messages) – requests and obligation – Describing trends (Adjectives and Adverbs) – Talking about company performance (present perfect and past simple, Reasons and consequences) – Reading Test Practice Describing products Dimensions, (Comparatives and Superlatives, Question formation) – Talking about product development (Sequencing words, Present continuous and going to) – Articles – Prepositions- Synonyms – Antonyms- Recommendations-**Interpretation of a chart**.	12
III	Talking about business equipment (Giving Instruction) – Letter Phrases- Writing Test Practice- Talking about facilities(Asking for and giving direction)- Presentation on a general topic -Talking about traffic and transport(making predictions)-**Discussion on current affairs**– Tenses- Present – Past-Future-Forms of verbs- Word techniques- Formation-Prefixes-Suffixes.	12
IV	Talking about conference arrangement(checking and confirming) – Talking about a conference before, after, when, until etc. – Listening Test Practice- talking about production process – passive- Talking about quality control Conditional 1 (real) (Making suggestions) – Itinery- Jumbled sentences- Paragraph writing- Essay writing – Checklist- Letter to Inviting Dignitaries – Accepting invitation- Declining Invitation.	12
V	Talking about call centers, insurance and changes in working practices (future possibility/probability)- Talking about banking- Speaking Test practice – Talking about delivery services (preposition of Time)- Talking about trading (Tense review)- Talking about recruitment conditional 2 (hypothetical) – talking about job applications (indirect questions) – Reading, Writing and Listening Test – Job application Letter and Resume Writing- Permission letters.	12
	Total Instructional Hours	**60**

Course Outcome

CO1 - Recognize different parts of speech for better usage.
CO2 - Interpret and illustrate formal communication
CO3 - Choosing right lexical techniques for effective presentation.
CO4 - Analyze and list out things in logical order.
CO5 - Create and integrate ideas in a professional way.

TEXT BOOKS:

T1 - NormanWhitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
R2 - Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi, 2005
R3 - KamaleshSadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16GE1103	PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to All Branches)	3	0	0	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.
4. To define Python functions and call them.
5. To use Python data structures – lists, tuples, dictionaries.
6. 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:To find the greatest among three numbers, prime numbers,find minimum in a list, 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, compute Simple interest for a given amount, Factorial of a given number ,distance between two points.	9
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.	9
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,histogram.	9
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,copy file.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, students will be able to

CO1:Develop algorithmic solutions to simple computational problems

CO2:Structure simple Python programs for solving problems.

CO3: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 –Ashok Namdev Kamthane ,Amit Ashok Kamthane ," Programming and Problem solving with Python" McGrawHill Education

T2-Sheetal Taneja, "Python Programming A Modular Approach With Graphics,Database,Mobile and Web Applications, PEARSON .

REFERENCE BOOKS:

R1 - Reema Thareja " Python Programming Using Problem Solvimg Approach " OXFORD.

R2-E.Balagurusamy, "Problem solving and Python Programming" McGrawHill Education.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	16GE1102	ENGINEERING GRAPHICS (Common to all Branches)	2	0	4	4

Course Objective
1. To provide drafting skills for communicating the Engineering concepts and ideas.
2. To expose to BIS and International standards related to engineering drawings.

Unit	Description	Total Hours
I	**PLANE CURVES** Importance of engineering drawing, drafting instruments, drawing sheets – layout and folding, Lettering and dimensioning, BIS standards and scales. Geometrical constructions, 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.	15
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** 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).	15
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane and objects inclined to both the planes by rotating object method.	15
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** 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. Intersection of solids-cylinder vs cylinder.	15
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections of 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. Perspective projection of solids in simple position using visual ray method.	15
	Total Instructional Hours	**75**

Course Outcome
CO1: Draw the orthographic and isometric views of regular solid objects including sectional views.
CO2:Recognize the International Standards in Engineering Drawing practices.

TEXT BOOKS:

T1 - K.Venugopal, V.Prabu Raja, “Engineering Drawing, AutoCAD, Building Drawings”, 5th Edition New Age
International Publishers, New delhi 2016.
T2 - K.V.Natarajan, “A textbook of Engineering Graphics”, Dhanalaksmi Publishers, Chennai.

REFERENCE BOOKS:

R1 - BasantAgrawal and C.M.Agrawal, “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited,New Delhi 2008.
R2 - K. R. Gopalakrishnan, “Engineering Drawing” (Vol. I & II), Subhas Publications, Bangalore, 1998.
R3 - M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson Education, India, 2005.
R4 - 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	16PS1001	PHYSICAL SCIENCES LAB - I Physics Lab I (Common to all Branches)	0	0	2	1

Course Objective

1. Evaluate the particle size of micro particles and acceptance angle of fibres.
2. Employ instrumental method to determine Young's modulus of a beam of metals.
3. Apply the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum.

Expt. No.	Description of the Experiments
1.	Determination of Wavelength, and particle size using Laser
2.	Determination of acceptance angle and numerical aperature in an optical fiber.
3.	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4.	Determination of wavelength of mercury spectrum – spectrometer grating
5.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
6.	Determination of Young's modulus by Non uniform bending method
7.	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
8.	Post office box Measurement of an unknown resistance
	Total Practical Hours 30

Course Outcome

CO:1 Point out the particle size of micro particles and acceptance angle of fibres using diode laser.
CO:2 Assess the Young's modulus of a beam using non uniform bending methods.
CO:3 Illustrate the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum Using spectrometer.
CO:4 Identify the velocity of ultrasonic's in the given liquid.
CO:5 Illustrate phenomena of thermal conductivity of a bad conductor.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	16PS1001	PHYSICAL SCIENCES LAB - I Chemistry Lab – I (Common to all Branches)	0	0	2	1

Course Objective

1. Acquire practical skills in the determination of water quality parameters.
2. Acquaint the students with the determination of molecular weight of a polymer by viscometry.
3. Acquaint the students with the estimation of chemical substances using instrumental analysis techniques.

Expt. No.	Description of the Experiments
1.	Preparation of molar and normal solutions and their standardization.
2.	Estimation of total, permanent and temporary hardness of Water by EDTA
3.	Determination of chloride content of water sample by argentometric method.
4.	Determination of available chlorine in bleaching powder.
5.	Conductometric titration of strong acid vs strong base (HClvsNaOH).
6.	Conductometric titration (Mixture of weak and strong acids)
7.	Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8.	Determination of molecular weight and degree of polymerization using viscometry.
9.	Estimation of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).
	Total Practical Hours **30**

Course Outcome

CO1: Estimate the different types of hardness in a water sample.
CO2: Determine the chloride content of water sample.
CO3: Calculate the strength of acid using conductometric titrations.
CO4: Calculate the strength of strong and weak acid using conductometric titrations.
CO5: estimate the amount of salt using conductometric precipitation titrations.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	16GE1004	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY** (Common to all Branches)	0	0	4	2

Course Objective

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python.

Ex.No	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
1	Compute the GCD of two numbers.	3
2	Find the square root of a number (Newton‘s method)	3
3	Exponentiation (power of a number)16	3
4	Find the factorial of a given number	3
5	Print prime numbers from 1 to n numbers	3
6	Find the maximum of a list of numbers	3
7	Linear search and Binary search	3
8	Selection sort, Insertion sort	3
9	Merge sort	3
10	First n prime numbers	3
11	Multiply matrices	3
12	Programs that take command line arguments(word count)	3
13	Find the most frequent words in a text read from a file	3
14	Simulate elliptical orbits in Pygame	3
15	Simulate bouncing ball using Pygame	3
	TOTAL INSTRCTIONAL HOURS	**45**

Course Outcome

CO1: Write, test, and debug simple Python programs.
CO2: Implement Python programs with conditionals and loops.
CO3:Develop Python programs step-wise by defining functions and calling them.
CO4:Use Python lists, tuples, dictionaries for representing compound data.
CO5:Read and write data from/to files in Python.

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	16GE1002	ENGINEERING PRACTICES LAB (Common to all Branches)	0	0	4	2

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

GROUP A (CIVIL & MECHANICAL)

Expt. No. **Description of the Experiments**

I CIVIL ENGINEERING PRACTICE

Study of plumbing and carpentry components of Residential and Industrial buildings.

(A) PLUMBING WORKS:

1 Study on pipe joints, its location and functions: Valves, taps, couplings, unions, reducers, elbows in household fittings.

2 Study of pipe connection requirements for pumps.

3 Preparation of plumbing line sketches for water supply and sewage works.

4 Hands-on-exercise:
- Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

5 Demonstration of plumbing requirements of high-rise buildings.

(B) CARPENTRY USING POWER TOOLS ONLY:

1 Study of the joints in roofs, doors, windows and furniture.

2 Hands-on-exercise in wood works by sawing, planning and cutting.

IIMECHANICAL ENGINEERING

(A) Welding:

1 Preparation of arc welding of Butt joints, Lap joints and Tee joints

(B) Machining:

1 Practice on Simple step turning and taper turning

2 Practice on Drilling Practice

(C) Sheet Metal Work:

1 Practice on Models– Trays, cone and cylinder.

DEMONSTRATION

(D) Smithy

- Smithy operations: Upsetting, swaging, setting down and bending.
- Demonstration of – Production of hexagonal headed bolt.

(E) Gas welding

(F) Foundry Tools and operations.

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GROUP B (ELECTRICAL & ELECTRONICS)

S.No	Description of the Experiments
	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 RLC circuit.
5	Measurement of energy using single phase energy meter.
	ELECTRONICS ENGINEERING PRACTICES
1	Study of Electronic components and equipments – Resistors - colour coding
2	Measurement of DC signal - AC signal parameters (peak-peak, RMS period, frequency) using CRO.
3	Study of logic gates AND, OR, NOT and NAND .
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5	Measurement of average and RMS value of Half wave and Full Wave rectifiers.
	Total Practical Hours 45

Course Outcome	CO1: Fabricate wooden components and pipe connections including plumbing works. CO2: Fabricate simple weld joints. CO3: Fabricate electrical and electronics circuits.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16 MA2102	ENGINEERING MATHEMATICS–II **(Common to all Branches)**	3	2	0	4

Course Objective

1. Learn the basics of vector calculus comprising gradient, divergence, Curl and line, surface, volume integrals.
2. Understand analytic functions of complex variables and conformal mappings.
3. Know the basics of residues, complex integration and contour integration.
4. Apply Laplace transform techniques to solve linear differential equations.
5. Know the effective mathematical tools for the solutions of partial differential equations that model several physical problemsin mathematical physics

Unit	Description	Instructional Hours
I	**VECTORCALCULUS** Gradient,divergenceandcurl–Directionalderivative–Irrotational andsolenoidalvector fields–Vectorintegration –Green'stheoreminaplane,Gauss divergencetheoremandStokes' theorem (excludingproofs)–Simpleapplicationsinvolvingcubesandrectangular parallelopipeds.	12
II	**ANALYTIC FUNCTIONS** Analytic function -Cauchy-Riemann equations -sufficient conditions (excluding proof) – Harmonic - conjugate harmonic functions– Constructionofanalytic functions (Milne-Thompson method)–Conformal mapping:w= z+c,cz,1/z and bilinear transformation without problems related to the concept of conformal mapping.	12
III	**COMPLEX INTEGRATION** Complexintegration–StatementsofCauchy'sintegral theorem– Taylor's and Laurent's series expansions - Singular points–Residues–Cauchy'sresidue theorem – Evaluation of real definite integrals as contour integrals around unit circle.	12
IV	**LAPLACETRANSFORM** Laplacetransform–Basic properties –Transforms ofderivatives andintegrals offunctions-Transformsofunitstepfunctionandimpulsefunction–Transformofperiodic functions. InverseLaplacetransform-Convolutiontheorem (without proof) – Solutionof linear ODE of second order with constant coefficientsusing Laplace transformation techniques.	12
V	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by 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- Linear homogeneous partial differential equations of second and higher order with constant coefficient.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Know the gradient, divergence and curl of vectors useful for engineering application like fluid flow, electricity and magnetism.
CO2: Test the analyticity to construct the analytic function and transform complex functions from one plane to another plane graphically.
CO3: Evaluate real and complex integrals over suitable closed paths or contours.
CO4: Know the applications of Laplace transform and its properties and to solve certain linear differential equations using Laplace transform technique.
CO5: Solve the engineering problems using Partial Differential Equations.

TEXT BOOKS:

T1 - Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2 - Veerarajan T, "Engineering Mathematics–II", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS :

R1 - BaliN.P&ManishGoyal,"ATextbookofEngineeringMathematics",8th Edition,Laxmi Pub. Pvt. Ltd.2011.
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.
R4 - Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol II, Second Edition, Pearson publishing,2011.
R5 -Wylie & Barett,"Advanced Engineering Mathematics", McGraw Hill Education, 6th edition,2003

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16PH2102	PHYSICS OF MATERIALS (Common to all Branches)	3	0	0	3

Course Objective

1. Gain knowledge about conducting materials.
2. Provide fundamental knowledge of semiconducting materials which is related to the engineering program.
3. Extend the properties of magnetic materials, applications and super conducting materials.
4. Defend the various types of dielectric materials and their uses.
5. Expose the students to smart materials and the basis of nano technology.

Unit	Description	Instructional Hours
I	**CONDUCTINGMATERIALS** Introduction – Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.	9
II	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors –direct and indirect band gap of semiconductors- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications	9
III	**MAGNETIC & SUPERCONDUCTING MATERIALS** **Magnetic Materials**: 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. **Superconducting Materials :** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.	9
IV	**DIELECTRIC & COMPOSITES MATERIALS** Introduction – Electrical susceptibility – dielectric constant – polarization - electronic, ionic, orientation and space charge polarization –internal field – Claussius – Mosotti relation (derivation) – dielectric loss and dielectric breakdown (qualitative)Introduction to composites materials – types of composites materials – polymer, metallic and ceramic matrix composites (qualitative). Application in surgery, sports equipment.	9
V	**SMART MATERIALS AND NANOTECHNOLOGY** **New Engineering Materials:** Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications. **Nano Materials**: Synthesis - plasma arcing – Chemical vapour deposition – properties of nanoparicles and applications. – Carbon nano tubes – fabrication – pulsed laser deposition - Chemical vapour deposition - properties & applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Illustrate the electrical / thermal conductivity of conducting materials.
CO2: Understand the purpose of the acceptor or donor levels and the band gap of a semiconductor.
CO3:Interpret the basic idea behind the process of magnetism and applications of magnetic materials in every day life
CO4:Identify and compare the various types of dielectric polarization and dielectric breakdown.
CO5:Evaluate the properties and applications of various advanced engineering materials and develop the new ideas to synthesis Nanomaterials

TEXT BOOKS:

T1 - S.O.Pillai "Solid State Physics" New Age International Publishers, New Delhi – 2011
T2- Rajendran V "Materials Science" McGraw-Hill Education" New Delhi -2016.

REFERENCE BOOKS:

R1 - William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2014.
R2 - Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2016.
R3 -Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY2103	CHEMISTRY FOR CIVIL ENGINEERING (B.E. Civil Engineering)	3	0	0	3

Course Objective

1. To be conversant with the principles of electrochemistry, corrosion of materials and corrosion prevention.
2. To acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
3. To gain knowledge on industrial importance of Phase rule and alloys
4.To acquireknowledge on the preparation, properties and applications of engineering materials.
5.To be conversant with the types of fuels, calorific value calculations, manufacture of various types of fuels.

Unit	Description	Instructional Hours
I	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells - reversible and irreversible cells – EMF – measurement of EMF – Single electrode potential – Nernst equation (problem) – electrochemical series – significance. Corrosion- causes- types - Chemical corrosion: oxidation corrosion – Pilling-Bedworth rule; electrochemical corrosion: mechanism – hydrogen evolution mechanism – oxygen absorption mechanism – galvanic corrosion – differential aeration corrosion; factors influencing corrosion; corrosion control: cathodic protection:sacrificial anodic protection – impressed current cathodic protection electroplating: electroplating of gold; electroless plating: advantages over electroplating – electroless plating of nickel.	9
II	**CHEMICAL THERMODYNAMICS** Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs Helmholtz equation- Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore.	9
III	**PHASE RULE AND ALLOYS** Phase rule: Introduction, definition of terms with examples, One Component System- water system- Reduced phase rule - Two Component Systems- classification – lead-silver system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.	9
IV	**ENGINEERING MATERIALS** Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses.	9
V	**FUELS AND COMBUSTION** Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Illustration of the type of corrosion, its mechanism and corrosion control methodologies.
CO2: Knowledge on second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
CO3: Summarize the classification, preparation, properties and application of ferrous and non ferrous alloys.
CO4: Understand the manufacture, properties and uses of various engineering materials.
CO5: Classify the various types of fuel and their analysis and other techniques.

TEXT BOOKS:

T1 - P.C.Jain& Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2015).
T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCE BOOKS:

R1 - B.Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
R2 - B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2005).
R3 - S.S.Dara “A Text book of Engineering Chemistry” S.Chand & Co.Ltd., New Delhi (2010).

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BE	16HE2102R	ESSENTIAL ENGLISH FOR ENGINEERS – II (Common to all Branches)	3	2	0	4

Course Objective

1. The learner will be introduced to global corporate culture and professional communication.
2. It helps the students to focus on organizing professional event and documentation.
3. The student will be able to describe the events and process in an effective way.
4. It trains the student to analyze the problems and to find solution to it.
5 .The learner will be familiar with business communication.

Unit	Description	Instructional Hours
I	Introduction- talking about teamwork- Making arrangements- Improving Communication in spoken language – Taking and leaving Voice mail messages (present Tense, Past Tense and Present Perfect) Talking about Business Hotel- (Speaking Activity) Talking about Corporate Hospitality- Formal and Informal Language – Making accepting and declining invitations (Auxiliary Verb, Countable or Uncountable Nouns) – Focus on Language – Definitions and Extended Definitions-**Reading comprehension.**	12
II	Talking about orders – Clarity Written Language – Phone and Letter Phrases – Talking about Company Finances – Conditional 1 and 2 – Managing Cash Flow (Intention and Arrangements Conditional 1 and 2) – Talking about Brands and Marketing – Ethical Banking- Talking about Public Relations – Organizing a PR Event – Describing Duties and Responsibilities – (Future Tense and Articles) – Reported Speech – Modal Verbs and Passive, Impersonal Passive Voice-**interpretation of posters or advertisements.**	12
III	Talking about relocation – Report Phrases – Talking about Similarity and difference- Giving Directions- Asking for Information and Making Suggestions – Talking about Location (Comparatives and Superlatives, Participles) – Talking about Company Performances- Describing Trends – Describing Cause and Effect – Talking about Environmental Impact – Discussing Green Issues – Language of Presentations (Adjectives and Adverbs, Determiners)- Homophones – Homonyms- Acronyms-Abbreviations- British and American words.	12
IV	Talking about Health and Safety – Expressing Obligation- Discussing Regulations- Talking about personnel Problems – Passives – Talking about Problem at Work (modal Verbs, Passives)- Talking about Expenses Claims- Talking about Air Travel (Relative Pronoun, Indirect Questions) – **E-mail Writing - Note completion-** Transcoding.	12
V	Talking about staff Benefits- Talking about Appraisal Systems (gerunds and Infinitives, Reported Speech) – Talking about Marketing Disasters – Expressing hypothetical Situations- Talking about entering Foreign Market (Conditional 3, Grammar review) – Letter for calling quotations, Replying for quotations – Placing an order and Complaint and **reply to a complaint**.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Introduced corporate culture and professional communication.
CO2: It focused on organizing a professional event and its documentation.
CO3: Improved the ability to describe the events and process in an effective way
CO4: Trained to analyze the problems and to find solution to it.
CO5: Practiced to make business communication.

TEXT BOOKS:

T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
T2 - Ian Wood and Anne Willams. “Pass Cambridge BEC Preliminary”, Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Communication Skills for Engineers, Sunitha Misra & C.Murali Krishna, Pearson Publishers
R2 - Technical Communication, Daniel G. Riordan, Cengage learning publishers.
R3 - Kamalesh Sadanan “A Foundation Course for the Speakers of Tamil-Part-I &II”, Orient Blackswan,2010.

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PROGRAMME	COURSE	NAME OF THE COURSE	L	T	P	C

	CODE					
B.E- (AERO, AUTO, CIVIL, MECH & MECHAT)	16GE2101	ENGINEERING MECHANICS (common to all Branches)	3	2	0	4

Course Objective

The main objectives of the course are to:

1. Understand the vector and scalar representation of forces and moments
2. Understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. Understand the principle of work and energy.
4. Comprehend the effect of friction on equilibrium.
5. Write the dynamic equilibrium equation.

UNIT	DESCRIPTION	TOTAL HOURS
I	**BASICS & STATICS OF PARTICLES** Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vector representation of forces and moments – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle –Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.	12
II	**EQUILIBRIUM OF RIGID BODIES** Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis– Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions.	12
III	**PROPERTIES OF SURFACES AND SOLIDS** Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – Second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas.	12
IV	**DYNAMICS OF PARTICLES** Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies. Co-efficient of restitution.	12
V	**FRICTION** Frictional force – Laws of Coloumb friction – Simple contact friction – Rolling resistance – Wedge friction - Belt friction, Applications of friction.	12
	TOTAL INSTRUCTIONAL HOURS	**60**

Course Outcome

The outcomes of the course are the students shall have the ability:

CO1: To solve engineering problems dealing with force, displacement, velocity and acceleration.
CO2: To analyze the forces in any structure.
CO3: To solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. F.P.Beer, and Jr. E.R.Johnston., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).

REFERENCE BOOKS:

1. R.C.Hibbeller, and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. S.Rajasekaran and G.Sankarasubramanian, "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
3. S.S.Bhavikatti, and K.G.Rajashekarappa, "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.

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Programme	Course Code	Name of the Course	L	T	P	C

B.E	16EE2202	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (Common to AERO, AUTO, CIVIL, MECH & MECHAT)	3	0	0	3

Course Objective

1. To apply the basic laws used in Electrical circuits and the different components.
2. To impart knowledge on construction and working of DC and AC machines
3. To provide knowledge on the fundamentals of semiconductor devices and their applications.
4. To impart knowledge on digital electronics and its principles.
5. To develop block diagrams for satellite and optical fiber communications.

Unit	Description	Instructional Hours
I	**ELECTRICAL CIRCUITS AND MEASUREMENTS** 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
II	**ELECTRICAL MACHINES** 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
III	**SEMICONDUCTOR DEVICES AND APPLICATIONS** 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
IV	**DIGITAL ELECTRONICS** 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
V	**FUNDAMENTALS OF COMMUNICATION ENGINEERING** Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations - Satellite and Optical Fibre communications (Block Diagram Approach only).	9
	TOTAL INSTRUCTIONAL HOURS	**45**

COURSE OUTCOME

At the end of this Course, students will be able to:

- Apply the KVL and KCL in Electrical circuits
- Explain the constructional features of AC and DC machines.
- Identify electronics components and use of them to design circuits.
- Use appropriate logic gates in circuit design.
- Construct block diagram and explain satellite and optical Fibre communication systems.

TEXTBOOKS

T1:Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
T2:Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.
T3:Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.

REFERENCES

R1:Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
R2:Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
R3:Premkumar N, "Basics of Electrical Engineering", Anuradha Publishers, 2003.
R4:T.Thyagarajan. "Fundamentals of Electrical and Electronics Engineering" Scitech Publications Pvt Ltd, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C

B.E	16PS2001	PHYSICAL SCIENCES LAB – II Physics Lab II (Common to all Branches)	0	0	2	1

Course Objective

1. Evaluate the band gap of a semiconductor.
2. Apply the concept of interference and calculate the thickness of thin wire.
3. Acquire the practical skills in Young's modulus by uniform bending method.

Expt. No.	**Description of the Experiments**
1.	Determination of Young's modulus by uniform bending method
2.	Determination of band gap of a semiconductor
3.	Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4.	Determination of Dispersive power of a prism - Spectrometer
5.	Determination of thickness of a thin wire – Air wedge method
6.	Determination of Rigidity modulus – Torsion pendulum
7.	Magnetic hysteresis experiment.
8.	Calibration of ammeter using potentiometer

Total Practical Hours 30

Course Outcome

CO: 1. Experiment involving the physical phenomena of the Rigidity modulus of wire.
CO: 2. Determine the band gap of a semiconductor and variation of Energy Gap (E_g)with temperature.
CO: 3 Assess the Young's modulus of a beam using non uniform bending method.
CO: 4. Explain the concept of interference and calculate the thickness of thin wire and other fine objects.
CO:5. Experiment provides a unique opportunity to validate Dispersive power of a prism using Spectrometer.

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	Code					
B.E	16PS2001	PHYSICAL SCIENCES LAB - II Chemistry Lab – II **(** Common to all Branches**)**	0	0	2	1

Course Objective

1. Acquire practical skills in the quantitative analysis of water quality parameters.
2. Acquire practical skills in the instrumental methods for quantitative Estimation of metal ion content.
3. Gain knowledge in determination of rate of corrosion.

Expt. No.	**Description of the Experiments**
1.	Determination of Dissolved Oxygen in water by Winkler's method.
2.	Estimation of alkalinity of water sample by indicator method.
3.	Estimation of hydrochloric acid by pH metry.
4.	Estimation of ferrous iron by Potentiometry.
5.	Estimation of Copper by EDTA
6.	Determination of sodium by flame photometry
7.	Determination of corrosion rate of mild steel by weight loss method.
	Total Practical Hours **30**

Course Outcome

CO1: Determine the level of DO in a water sample.
CO2: Identify and estimate the different types of alkalinity in water sample.
CO3: Estimate the acidity of water sample using pH metry.
CO4: Estimate the amount of copper in a brass sample.
CO5: Determine the metal ion content using instrumental methods.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE2001	COMPUTER AIDED DRAWING LAB	0	0	4	2

Course Objective
1. To develop skill to use software to create 2D Drawing.
2. To provide students with the necessary knowledge in drafting skills.

1. Study of capabilities of software for Drafting – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon and general multi-line figures.
2. Drawing of Curves like parabola, ellipse and spiral.
3. Drawing of Involutes of circle, square and Pentagon.
4. Drawing of a Title Block with necessary text and projection symbol.
5. Drawing of Front view, Top view and Sectional Plan of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
6. Drawing of Isometric projections of simple objects.
7. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
8. Drawing of a Plan and Elevation and Sectional view of Residential Building (Single bed room, kitchen, hall, etc.)
9. Preparation of a Layout showing the Electrical Connections, Appliances and Fixtures in a Residential Building.
10. Preparation of a Layout showing Plumbing Connections, Pipelines and Fixtures in a Residential Building.
11. Drawing of Steel Trusses.

Total Practical Hours 45

Concepts and Conventions:
Understand draw panel and modify panel, line types, creating dimensions, hatching techniques, layer Creations, text styles, and template drawings, use of Blocks, Design Center, Tool Palettes and Plotting.
Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

Course Outcome
CO1.Ability to use the software packages for drafting
CO2.Ability to create 2D Drawing of Engineering Components
CO3. Apply basic concepts to develop construction drawing techniques

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No	Description of Equipment Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility30 Nos.
2.	Licensed software for Drafting-30 Licenses.
3.	Laser Printer or Plotter to print / plot drawings-2 Nos.

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS :

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3201	MECHANICS OF SOLIDS	3	2	0	4

Course Objective

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

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

Course Outcome

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

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

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

CO3: Analyse the beam for internal stress.

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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

Course Objective

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

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

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Use fluid properties to design pipes to carry particular amount of discharge.
CO2: Solve fluid statics problems and measure fluid pressure
CO3: Distinguish between various types of fluid flows and find the fluid velocity and discharge using principles of Kinematics and Dynamics.
CO4: Identify the laminar and turbulent flow through pipes and compute the energy losses in pipe flow.
CO5:Select appropriate model to provide solution to a real time problem related to hydraulics.

TEXT BOOKS:

T1 -Jain A.K., "Fluid Mechanics (including Hydraulic Machines)", Khanna Publishers, 2010.
T2 - Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2013.

REFERENCE BOOKS:

R1 -Pani B.S. "Fluid Mechanics: A concise introduction" PHI Learning EEE 2016
R2-Ramamrutham,S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons,Delhi,2014.
R3 -Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS :

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4201	STRENGTH OF MATERIALS	3	2	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
I	**ANALYSIS OF TRUSSES** Perfect, deficient and redundant trusses - Degree of redundancy – Internal and external redundancy – Methods of analysis - Method of joints - Method of sections - Method of tension coefficients - Analysis of Space Truss.	**9+3**
II	**THIN AND THICK CYLINDERS AND THEORIES OF ELASTIC FAILURE** Thin cylinders – Circumferential stress – Longitudinal stress – Volumetric strain - Stresses in thick cylindrical shell– Lame's equation – Stresses in compound cylinders – Shrink fit - Failure theories - Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- Strain energy theory- maximum shear strain energy theory.	**9+3**
III	**COLUMNS AND STRUTS** Short and slender columns- Axial and bending stress – Kern of a section - buckling and stability – Columns with pinned ends - Columns with other support conditions - Columns with eccentric loads - Euler theory and Rankine's formula - Elastic and inelastic column behaviour – Design formulae for columns.	**9+3**
IV	**DEFLECTION OF BEAMS** Deflection of beams - Geometric methods - Double integration method – Macaulay's method – Moment-Area method - Conjugate beam method.	**9+3**
V	**UNSYMMETRICAL BENDING** Unsymmetrical bending- Symmetrical and unsymmetrical sections - Bending stresses in beams - Shear centre - Shear centre for thin walled beam of mono- Symmetric and unsymmetrical open sections.	**9+3**
	Total Instructional Hours	**45+15=60**

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4202	APPLIED HYDRAULICS AND 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 - Wide open channel -Specific energy -Critical flow and its computation - channel transition.	**8**
	UNIFORM FLOW	
II	Uniform flow -Velocity measurement - Manning's and Chezy's formula - Determination of roughness coefficients - Determination of normal depth and velocity - Most economical sections - Non-erodible channels.	**8**
	VARIED FLOW	
III	Dynamic equations of gradually varied flow - Assumptions - Characteristics of flow profiles - Draw down and back water curves - Profile determination - Graphical integration, direct step and standard step method - Flow through transitions – Hydraulic jump – Types - Energy dissipation – Surges.	**9**
	TURBINES	
IV	Impact of Jet on vanes - Turbines - Classification – Velocity triangle - Governing and selection of turbine - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Similarity laws.	**10**
	PUMPS	
V	Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.	**10**
	Total Instructional Hours	**45**

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

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

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

CO4:Applythe knowledge in carrying out soil testing.

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

R1 -Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 4th Edition, 2015.
R2 -Guocheng Xu, “GPS Theory, Algorithms and Applications", Springer - Berlin, 2016.
R3-Kanetkar.T.P.,and Kulkarni.S.V., ―Surveying and leveling, Vol I & II,Pune Vidyarthi Griha,Prakashan,2012.

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

T1- S K Khanna and C E G Justo, “Highway Engineering”, Nem Chand and Brothers, Roorkee, 2015
T2- SaxenaSubhash C and Satyapal Arora, “A Text book of Railway Engineering”, Dhanpat Rai and Sons, Delhi, 2010.

REFERENCE BOOKS:

R1- S.P. Bindra, " Highway Engineering", Dhanpat Rai and Sons, Delhi,2014.
R2- L R Kadiyali, Principles and Practice of Highway Engineering, Khanna Publishers, Delhi,2005.
R3- G.V. Rao , "Principles of Transportation Engineering",Tata McGraw Hill Publication,2017.

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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

REFERENCE BOOKS:

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

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

Course Objective

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

Expt . No. **Description of the Experiment**

FLOW MEASUREMENT

1. Flow through Venturimeter, Orificemeter
2. Flow through variable duct area - Bernoulli‟s Experiment
3. Flow through Orifice, Mouthpiece and Notches

LOSSES IN PIPES

4. Determination of friction coefficient in pipes
5. Determination of loss coefficients for pipe fittings

PUMPS

6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

TURBINES

10. Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine
12. Characteristics of Kaplan turbine
13. Determination of Metacentric height (Demonstration)

Total Practical Hours 45

Course Outcome

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

REFERENCES:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE5201	STRUCTURAL ANALYSIS - I	3	2	0	4

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CODE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CODE BOOKS:

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

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

Course Objective

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

Unit	Description	Instructional Hours
I	**PLANNING OF WATER SUPPLY SYSTEM** 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
II	**CONVEYANCE** 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
III	**WATER TREATMENT** Objectives – Unit operation and processes – Screens, Principles & functions of chemical feeding, flash mixers, flocculators, sedimentation tanks and sand filters – Disinfection – Residue management – Construction, operation and maintenance of water treatment plants	10
IV	**ADVANCED WATER TREATMENT** Principles and functions of aeration – Iron and manganese removal – Defluoridation and demineralisation – Water softening – Desalination - Membrane systems – Recent advances.	8
V	**WATER DISTRIBUTION AND SUPPLY TO BUILDINGS** Requirements of water distribution - Distribution systems – Analysis of distribution networks – Computer applications – Leak detection methods - Principles of design of water supply to buildings – House service connections – Fixtures and fittings – Systems of plumbing - types of plumbing.	9
	Total Instructional Hours	**45**

Course Outcome

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

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

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

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

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

T1 - Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2004.
T2 - Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2011.

REFERENCE BOOKS:

R1 –Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013.
R2 - Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2012.
R3 - Punmia, B.C. " Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2017.

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

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

Total Practical Hours 45

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1: Carry out specific field investigations to collect, test, observe and record the soil characteristics and its behavior.
CO2: Identify and classify soil based on standard geotechnical engineering practice.
CO3: Conduct tests to determine and demonstrate the index properties of soil.
CO4: Estimate compressive strength, shear strength, permeability and other engineering properties of soil
CO5: Assess and justify the suitability of soil for construction purposes based on test results.

REFERENCE BOOKS:

R1 - Braja. M Das ,"Soil Mechanics: Laboratory Manual" Oxford University Press , 2012.
R2 - Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) Limited Publishers, New Delhi, 2002.
R3 - Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Total Practical Hours 2 weeks

Course Outcome

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE6201	STRUCTURAL ANALYSIS - II	3	2	0	4

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1:Analyze and design of different types of retaining walls and will able to apply the theoretical concepts in the real world construction.
CO2: Design and detail the different types of water tanks along with the staging and foundation.
CO3: Design and detail the flat slabs and reinforced concrete walls.
CO4: Design square, rectangular, circular and triangular slabs using Yield line theory.
CO5: Design and detail the different types of bridges.

TEXT BOOKS:

T1-Krishna Raju, N., “Design of RC Structures”, CBS Publishers and Distributors, New Delhi,2016.
T2-Punmia B.C, Ashok Kumar Jain, ArunK.Jain, "R.C.C. Design of Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS:

R1-UnnikrishnaPillai, S., DevdasMenon, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd., New Delhi , 2009.
R2-Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012
R3-Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012

CODE BOOKS:

C1 -IS 456-2000: Plain and Reinforced Concrete - Code of Practice.
C2-SP 16 - Design Aids for Reinforced Concrete to IS 456:1978.
C3-IS 3370 (Part IV)- 1967: Code Of Practice for Concrete Structures for The Storage of Liquids.

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

Upon successful completion of the course, students will have ability to
CO1: Estimate the quantity of sewage produced and ascertain the type of sewerage system.
CO2:Design the sewers and select the sewer materials.
CO3:Determine the characteristics of sewage and design the unit operations.
CO4: Design the various biological treatment processes.
CO5:Interpret the various options for sewage disposal and sludge management.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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:Evaluate and recommend the degree of treatment required for water and wastewater.

REFERENCE BOOKS:

R1 –Standard Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 2015.

R2 – Drinking Water Specifications, Bureau of Indian Standards (IS 10500:2012).

R3 - .Manual on Sewerage & Sewage Treatment, Second Edition, CPHEEO, 2012.

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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

REFERENCE BOOKS:

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

CODE BOOKS:

C1- IS 456 – 2000 – Code of Practice for Plain and Reinforced Concrete Structures.
C2- IS 800 – 2007 – General Construction in Steel.
C3- IS 875(1, 2, 3)-1987 – Indian Standard Specification for Design Loads for Buildings.

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CODE BOOKS:

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

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

Course Objective

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

Unit	Description	Instructional Hours
I	**IRRIGATION PRACTICE** 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**
II	**DIVERSION HEADWORKS** 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**
III	**GRAVITY DAM** 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**
IV	**ARCH, BUTTRESS AND EARTH DAMS** 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**
V	**CANAL REGULATION WORKS** Canal falls – types – Design of vertical drop fall – Functions of Regulators - Design of head and cross regulators – Cross drainage works – types of cross drainage works – Selection of suitable types of cross drainage works – Classification of aqueducts and syphon aqueducts – Design features for cross drainage works.	**9**
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Compare the various methods of irrigation and estimate the optimum water requirement.

CO2: Apply the principles and theories for the design of diversion headworks.

CO3: Compute the forces, analyse and design gravity dams.

CO4: Compare and contrast the construction techniques and failure mechanisms of arch, buttress and earth dams.

CO5: Design the various units of canal regulation works.

TEXT BOOKS:

T1 - Santosh Kumar Garg, "Irrigation Engineering and Hydraulics Structures", Khanna Publications Pvt.Ltd.New Delhi, 2017.

T2 -Punmia .B.C. and Pande B.B.Lal, "Irrigation and Water Power Engineering", Laxmi Publications Pvt.Ltd. New Delhi, 2009.

REFERENCE BOOKS:

R1 -Sharma. R.K. and Sharma. T.K "Irrigation Engineering and Hydraulics Structures", S. Chand & company Pvt.Ltd, New Delhi, 2007.

R2 - Michel A.M., "Irrigation Engineering", Vikas Publishing House Pvt.Ltd, New Delhi, 2009.

R3- Asawa, G.L., "Irrigation Engineering", New Age International Publishers, New Delhi, 2000.

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

Course Objective

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

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

Total Practical Hours 45

Course Outcome

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

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

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

CO3: Design the various components of irrigation engineering structures.

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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

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

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

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

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

R1- Biggs, J.M., “Introduction to Structural Dynamics”, McGraw Hill Book Co., New York, 1964
R2- Pankaj Agarwal and Manish ShriKhande, “Earthquake Resistant Design of Structures”, Prentice- Hall Of India, 2007, New Delhi
R3- Mario Paz and William Leigh “Structural Dynamics – Theory & Computation”, Kluwer Academic Publishers, 2012

CODE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8901	PROJECT WORK	0	0	16	8

Course Objective

1. To develop the ability to solve a specific problem right from its identification, review literature, formulate proper methodology, conduct various tests and arrive at a solution.
2. To train the students to prepare project reports, face reviews and attend viva voce examination.

Description	Total Hours
The student in a group of 3 to 4 works on a topic approved by the Head of department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of Department. A project report is required at the end of the semester. The project work is evaluated based on an oral presentation and the project report jointly by external and internal examiners constituted by the Head of Department.	**180**

Course Outcome

On the completion of the project work, students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

CO1: Classify the bridges and develop a conceptual design with appropriate geometry and size of elements for a bridge.

CO2:Designthe Superstructure of bridges.

CO3:Be proficient in Substructure of bridges.

CO4:Evaluate the types of bearings used in bridges.

CO5: Analyze case studies on bridges and formulate the inspection procedure for bridge maintenance.

TEXT BOOKS:

T1-Ponnuswamy.S "Bridge Engineering", Tata McGraw-Hill, 2017.

T2-KrishnaRaju.N " Design of Bridges", Oxford and IBH , 2008.

REFERENCE BOOKS:

R1-Bakht.B and Jaegar.L.G., "Bridge Analysis Simplified", McGraw Hill, 1992.

R2-Johnson Victor.D, "Essentials of Bridge Engineering", Oxford & IBH, 2007.

R3-KrishnaRaju. N "Structural Design and Drawing: Reinforced Concrete and Steel" , University Press (India) Pvt Limited , 2004

CODE BOOKS:

C1- IRC: 6 - 2014 Standard Specifications and Code of Practice for Road Bridges, Section II - Loads and Stresses (Fifth Revision).

C2- IRC: 21 - 2000 Standard Specifications and Code of Practice for Road Bridges, Section III - Cement Concrete (Plain and Reinforced) (Third Revision).

C3- IRC: 22 - 2008 Standard Specifications and Code of Practice for Road Bridges, Section VI - Composite Construction (Limit States Design) (Second Revision).

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Signature and Name of the Chairman, BOS	**Principal / Dean (Academics)**

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

R1 -Willis, E.M., "Scheduling Construction projects", John Wiley and Sons,1986.
R2 - Halpin,D.W., "Financial and cost concepts for construction Management",John Wiley and Sons, New York, 1985.
R3 - Moder.J., C.Phillips and Davis, "Project Management with CPM, PERT and Precedence Diagramming", Van Nostrand Reinhold Co., Third Edition, 1983.

Dr. K. AKIL	
Signature and Name of the Chairman, BOS	**Principal / Dean (Academics)**

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

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

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

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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

Course Objective

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

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

Course Outcome

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

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

CO2:Implement the various elements in infrastructure planning.

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

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

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

TEXT BOOKS:

T1- RichardKintermann and Robertsmall, “Site planning for Cluster Housing”, Van Nastrand Reinhold company, Jondon / NewYork 2003.

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

REFERENCE BOOKS:

R1 – ChristopherAlexander,“A Pattern Language”, Oxford University press, NewYork 1977.

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

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

Dr. K. AKIL	
Signature and Name of the Chairman, BOS	**Principal / Dean (Academics)**

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

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

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

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

R1. Paul Samuelson & William Nordhaus., "Economics - An Introductory Analysis", 19th Edition, McGraw-Hill, 2010.
R2. Varshney R. L. and Maheshwary K. L. "Managerial Economics" 22nd Edition, Sultan Chand & Sons, 2014.
R3. Dwivedi D. N. "Managerial Economics", 7th Edition, Vikas Publishing House Pvt. Ltd., 2010.

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

Course Objective

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

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7304	HAZARDOUS WASTE MANAGEMENT AND SITE REMEDIATION	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
I	**INTRODUCTION** 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	**9**
II	**MANAGEMENT OF HAZARDOUS WASTES** 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.	**9**
III	**NUCLEAR WASTES AND E-WASTE** 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.	**9**
IV	**BIOMEDICAL AND CHEMICAL WASTES** 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.	**9**
V	**THE SCIENTIFIC LANDFILL** 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.	**9**
	Total Instructional Hours	**45**

Course Outcome

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

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

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

Course Objective

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

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

Course Outcome

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

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

CO2: Schematize various treatment options for industrial wastewater.

CO3: Recommend various advanced treatment methods for industrial wastewater.

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

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

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

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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 Publishing Co., Ltd., Delhi , 2007.
R2-S.K.Duggal, “Earthquake resistant design of structures”, Oxford University press, Delhi , 2007.

CODE BOOKS:

C1 -IS 883 (1994): Design of Structural Timber In Building -Code of Practice
C2 -IS 1905 (1987) : Code of Practice for Structural use of Unreinforced Masonry (Third Revision)

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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
I	**BEHAVIOUR OF LIFE LINE STRUCTURES** 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** Response of dams, bridges, buildings,Strengthening measures , Safety analysis and rating – Reliability assessment.	**9**
III	**REHABILITATION AND RETROFITTING** Testing and evaluation - Classification of structures for safety point of view – methods of strengthening for different disasters - qualification test.	**9**
IV	**DETAILING OF STRUCTURES AND COMPONENTS** Use of modern materials and their impact on disaster reduction, Use of modern analysis, design and construction techniques optimisation for performance.	**9**
V	**DAMAGE ASSESSMENT OF STRUCTURES** 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	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 – Planning for Components of prefabricated structures –Disuniting of structures – Handling and erection stresses –Elimination of erection stresses – Beams, columns - Symmetrical frames.	**9**
	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.	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 – Largrangean and Serendipity Elements – Numerical Elements.	**9**
	APPLICATIONS OF FINITE ELEMENT METHOD	
V	Finite Elements for Elastic Stability – Finite Elements in Fluid Mechanics – Dynamic Analysis – Bending of Elastic Plates – Time Dependent Problems in Elasticity.	**9**
	Total Instructional Hours	**45**

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7310	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
I	**PLANNING** Classification of Industries and Industrial structures –General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components	9
II	**FUNCTIONAL REQUIREMENT** Lighting – Ventilation – Accounts – Fire safety – Guidelines from factories act.	8
III	**DESIGN OF STEEL STRUCTURES** Industrial roofs – Crane girders - Design of Bunkers and Silos.	8
IV	**DESIGN OF R.C. STRUCTURES** Silos and bunkers – Chimneys – Principles of folded plates and shell roofs.	9
V	**POWER TRANSMISSION STRUCTURE** 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.	16CE8301	COMPUTER AIDED DESIGN OF STRUCTURES	3	0	0	3

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

R1- Krishnamoorthy C.S. and Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 2008.
R2- Rao S.S., "Optimization Theory and Applications", Wiley Eastern Ltd, New Delhi, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE8302	TALL BUILDINGS	3	0	0	3

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

T1- Taranath B. S., "Structural Analysis and Design of Tall Buildings", Tata McGraw Hill Publishing Company Ltd., New Delhi.2012

T2- Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Ltd., New Delhi.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.	16CE8303	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	3	0	0	3

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CODE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

CO2: Deduce the factors affecting the quality of concrete.

CO3: Suggest special concretes for various applications.

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

TEXT BOOKS:

T1- R.K. Gandhi, "Elements of Valuation of Immovable Properties",Tata McGraw –Hill 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

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

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

Course Outcome

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

Unit	Description	Instructional Hours
I	**CONTEXT FOR IWRM** 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**
II	**WATER ECONOMICS** 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**
III	**WATER SUPPLY AND HEALTH WITHIN THE IWRM CONSIDERATION** 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**
IV	**AGRICULTURE IN THE CONCEPT OF IWRM** 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**
V	**WATER LEGAL AND REGULATORY SETTINGS** Basic notion of law and governance: principles of international and national law in the area of water management. Understanding UN law on non - navigable uses of international water courses - Development of IWRM in line with legal and regulatory framework.	**9**
	Total Instructional Hours	**45**

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

Unit	Description	Instructional Hours
	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 - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.	**9**
	EARTH REINFORCEMENT	
IV	Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.	**9**
	GROUT TECHNIQUES	
V	Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring, Stabilization with cement, lime and chemicals - Stabilization of expansive soils.	**9**
	Total Instructional Hours	**45**

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

R1 - Peter. G. Nicholson, “ Soil improvement and ground modification methods”,Elsevier Inc, 2015
R2 - 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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AERONAUTICAL ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16AE6401	INTRODUCTION TO FLIGHT	3	0	0	3

Course Objective

6. To understand the concept of flying and instruments associated with it.
7. To gain knowledge about the structural design and material of aircraft components.
8. To provide the basic idea about the working principle of aircraft power plants.
9. To understand the concept of space vehicles.
10. To gain knowledge on helicopter flight mechanism.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO AIRPLANES** Introduction, historical background, Different types of flight vehicles, Components of an airplane and their functions. Conventional control, Basic instruments for flying. Physical properties and structure of the atmosphere, (Temperature, Pressure and altitude relationships), Evolution of lift, Drag and moment. Aero foils, Avionics: Flight deck and cockpit.	9
II	**AIRPLANE STRUCTURES AND MATERIALS** Introduction to structural design of Aircraft and spacecraft, flight loads, general types of construction, Monocoque, Semi-monocoque and composite structure construction, Typical wing and fuselage structure, Metallic and Nonmetallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials in aerospace.	9
III	**AIRCRAFT ENGINES** Selection of power plants: piston, turbo-propeller, turbofan, and jet engines with after burner / thrust augmentation thrust vector control, FADEC. Use of propeller and jets for thrust production, Comparative merits. Theory of Propellers.	9
IV	**SPACE SYSTEM DESIGN** Overview on space environment, introduction to space debris, Launch site selection, Brief introduction to rockets, ramjet, and SCRAMJET, Thrust vector control mechanisms, staging of rockets, space mission, re-entry vehicles, life support systems for manned space missions, Fuel cells, Introduction to space mechanics to satellites, Interplanetary missions, Space exploration.	9
V	**ROTORCRAFT, UAVs, AND AIRCRAFT SYSTEMS** Introduction to Helicopters and Micro-lights. Introduction to UAVs and MAVs. Types and applications, Maintenance, safety and operations. Basic principles and lay out of various aircraft systems: Hydraulic system, Aircraft Fuel system, Engine fuel system, Air conditioning and Pressurization system Flight control system, Navigation and Weapon control system, Under carriage and Brake system, High lift devices.	9
	Total Instructional Hours	**45**

Course Outcome

CO1. Understand about the fundamentals of various flight configurations.
CO2. Capable of choosing the correct material for specified components.
CO3. Understand about the basic science of aircraft engines.
CO4. Ability to understand about the space vehicles behavior.
CO5. Capable of implementing the ideas on helicopter aerodynamics.

TEXT BOOKS:

T1 - Anderson J.D., Introduction to Flight, McGraw-Hill 7th edition, 2013.
T2 - Austin R., Unmanned Aircraft Systems, AIAA Education Series, 2010.

REFERENCE BOOKS :

R1 - Dava Newman, Interactive Aerospace Engineering and Design, McGraw-Hill.2nd edition., 2002.
R2 - Kermode, A.C., "Mechanics of Flight", Himalayan Book, 1997
R3 - Kermode A.C, " Flight without formulae", Pearson Education,, Fifth edition,1989.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16AE7402	INDUSTRIAL AERODYNAMICS	3	0	0	3

Course Objective

1. To familiarize the atmosphere and effects of wind with various parameters.
2. To understand about the wind energy conversion systems and wind turbine design.
3. To learn and understand the road vehicles aerodynamics.
4. To acquire the knowledge about building aerodynamics and problems associated with tall & small building design.
5. To learn the concept of effect of wake formation and special vibration issues.

Unit	Description	Instructional Hours
I	**ATMOSPHERE** Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.	9
II	**WIND ENERGY COLLECTORS** Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.	9
III	**VEHICLE AERODYNAMICS** Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft	9
IV	**BUILDING AERODYNAMICS** Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.	9
V	**FLOW INDUCED VIBRATIONS** Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Identify the Atmospheric wind properties with various terrain fields.
CO2: Analyze the design concept of wind turbines & power efficiency.
CO3. Ability to understand the road vehicles aerodynamics in terms of drag reduction.
CO4: Understand the wind forces on buildings and architectural design parameters.
CO5: Apply the knowledge to bluff body aerodynamics and flow induced vibrations.

TEXT BOOKS:

T1 - M.Sovran (Ed), “Aerodynamics and drag mechanisms of bluff bodies and Road vehicles”, Plenum press, New York, 1978.
T2 - Sachs. P., “Winds forces in Engineering”, Pergamon Press, 1978.

REFERENCE BOOKS :

R1 - Blevins. R.D., “Flow Induced Vibrations”, Van Nostrand, 1990.
R2 - Calvent. N.G., “Wind Power Principles”, Charles Griffin & Co., London, 1979
R3- Tony Burton, Nick Jenkins, David Sharpe and Ervin Bossanyi, “Aerodynamics of Horizontal Axis Wind Turbines”John Wiley & Sons, Ltd, 2011

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AUTOMOBILE ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16AU6401	BASIS OF AUTOMOBILE ENGINEERING	3	0	0	3

Course Objective

1.To understand the basic fundamentals of automobile engineering
2.To acquire knowledge of automotive engines
3.To impart knowledge of various power transmission unit
4.To understand the principles of steering and brake systems
5.To know about automotive electrical systems and its functions

Unit	Description	Instructional Hours
I	**INTRODUCTION** Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel - rear wheel - four wheel.	8
II	**IC ENGINES** I.C. Engines - Classification - ignition system - firing order - Otto/ Diesel cycles - Two stroke and four stroke engines – scavenging - Cooling and Lubrication systems - Fuel Supply system – air fuel ratio - Carburetor - types.	9
III	**TRANSMISSION SYSTEM** Clutch - Function - single plate - multi plate - friction clutches - Centrifugal and semi centrifugal clutch - Gear Box - slide mesh - constant mesh and synchromesh gear box - Torque convertor – overdrive - Propeller shaft and rear axle - Universal joint – Differential - Rear axle drives - Wheels and Tyres.	10
IV	**STEERING AND BRAKE** Steering system - function and principle - Ackerman and Davis steering principles - steering and wheel geometry – steering gear boxes. Brakes - Mechanical - hydraulic and vaccum brake - master cylinder - wheel cylinder - Bleeding of brakes.	9
V	**ELECTRICAL SYSTEMS** Battery – types - Dynamo and Alternator – Cutout relay - Diagram of Wiring system - Lighting System and Accessories - Lighting system – Headlight - Lighting switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Provides basic platform knowledge of automobile engineering
CO2: Understand the working principal of petrol and diesel engines
CO3. Interpret the method of power transmission unit.
CO4: Built knowledge of steering and brake.
CO5: Acquired the knowledge of automotive electrical systems and functioning

Text Books

T1 Kirpal Singh, Automotive Engineering, Vol. I & II, Standard Publishers, New Delhi,2010.
T2 Gupta, S K"A Textbook of Automobile Engineering", Chand Publishing,2013.

References

R1 Rajput, R K, "A Textbook of Automobile Engineering", Firewall Media, 2007.
R2 Butterworth-Heinemann, " Automobile and Mechanical Electrical Systems", Tom Denton Publisher,2011.

Dr. K. AKIL	
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Programme	Course Code	Name of the Course	L	T	P	C
BE	**16AU7401**	**AUTOMOTIVE SAFETY**	3	0	0	3

Course Objective

1. To get good exposure an automotive safety
2. To understand the active and passive safety concepts
3. To acquire knowledge in safety equipments
4. To familiarize the warning systems
5. To recognize the various adjustment systems for comfort and convenience drive

Unit	Description	Instructional Hours
I	**INTRODUCTION** Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.	9
II	**SAFEY CONCEPTS** Active safety: driving safety - conditional safety - perceptibility safety - operating safety - passive safety: exterior safety - interior safety - deformation behaviour of vehicle body - speed and acceleration characteristics of passenger compartment on impact.	9
III	**SAFETY EQUIPMENTS** Seat belt – regulations - automatic seat belt tightener system - collapsible steering column - tiltable steering wheel - air bags - electronic system for activating air bags - bumper design for safety.	9
IV	**COLLISION WARNING AND AVOIDANCE** Collision warning system - causes of rear end collision - frontal object detection - rear vehicle object detection system - object detection system with braking system interactions.	9
V	**COMFORT AND CONVENIENCE SYSTEM** Steering and mirror adjustment - central locking system - Garage door opening system - tyre pressure control system - rain sensor system - environment information system.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Acquire knowledge in automotive safety and importance
CO2: Able to analyze the safety concepts
CO3. Understand the various safety equipments functions and importance
CO4: Able to know the function of warning and avoidance systems
CO5: Acquire knowledge on various adjustment and measurement importance for comfort and convenience riding

Text Books

T1 Powloski. J., “Vehicle Body Engineering”, Business books limited, London, 1969.
T2 Bosch, “Automotive Handbook”, 8th Edition, SAE publication, 2011.

References

R1 Ronald.K.Jurgen, “Automotive Electronics Handbook”, Second Edition, McGraw-Hill Inc., 1999.
R2 George A. Peters, Barbara J. Peters, ―Automotive Vehicle Safety – 2002.

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CIVIL ENGINEERING

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

Course Objective

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

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

Course Outcome

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE7402	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”, Affiliated Press 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 Smith Publication, 2003.

Dr. K. AKIL	
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COMPUTER SCIENCE ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16CS6401	SOFT COMPUTING	3	0	0	3

Course Objective

1. To learn the various soft computing frame works.
2. To understand the design of various neural networks.
3. To be exposed to fuzzy logic.
4. To learn about basic concepts of genetic algorithm and its operators.
5. To be exposed to hybrid systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Aims of Soft Computing - Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.	9
II	**NEURAL NETWORKS** McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN-associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network.	9
III	**FUZZY LOGIC** Membership functions: features, fuzzification, methods of membership value assignments - Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decompositionof rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.	9
IV	**GENETIC ALGORITHM** Genetic algorithm and search space - Principle of Genetic Algorithm -general genetic algorithm – operators - Genetic Algorithm Based Optimization - Genetic Algorithm with Directed Mutation - Comparison of Conventional and Genetic Search Algorithms - Issues of GA in practical implementation - Introduction to Particle swarm optimization-PSO operators - GA and PSO in engineering applications.	9
V	**HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS** Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral imageswith SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.	9
	Total Instructional Hours	**45**

Course Outcome

Upon successful completion of the course, students shall have ability to
CO1:Apply various soft computing frame works.
CO2:Design of various neural networks
CO3:Use fuzzy logic.
CO4:Apply genetic programming.
CO5:Discuss hybrid soft computing.

TEXT BOOKS:

T1 - J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
T2- S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCE BOOKS :

R1- S.Rajasekaran and G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
R2- George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.
R3 - David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.

Dr. K. AKIL	
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Programme	Course Code	Name of the Course	L	T	P	C
BE	16CS6402	OPTIMIZATION TECHNIQUES	3	0	0	3

Course Objective

1. Introducing the basic concepts of Linear Programming.
2. Educating on the advancements in Linear programming techniques.
3. Introducing Non Linear programming techniques.
4. Introducing the interior point methods of solving problems.
5. Introducing the Dynamic programming method.

Unit	Description	Instructional Hours
I	**LINEAR PROGRAMMING** Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.	9
II	**ADVANCES IN LPP** Dualit theory- Dual simplex method - Sensitivity analysis–-Transportation problems– Assignment problems-Traveling sales man problem -Data Envelopment Analysis.	9
III	**NON LINEAR PROGRAMMING** Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.	9
IV	**INTERIOR POINT METHODS** Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.	9
V	**DYNAMIC PROGRAMMING** Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion–Computational procedure–Conversion offinal value problem in to Initial value problem..	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the ethical issues
CO2: Understand the environmental impact
CO3: Gain knowledge of management skills
CO4: To analyze the problems and find the optimized solution
CO5: Explain the principle of dynamic programming

TEXT BOOKS:

T1 - Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
T2 - R.Panneerselvam, "Operations Research", PHI, 2006.
T3 - HamdyATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.

REFERENCE BOOKS :

R1 - Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
R2 - Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd.New Delhi, 2005

Dr. K. AKIL	
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ELECTRONICS AND INSTRUMENTATION ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16EI6401	Neural Networks and Fuzzy Systems	3	0	0	3

Course Objective

1. Introduce about Artificial Neural Networks.
2. Classify on various Neural Network Architectures and its Training Algorithms.
3. To learn about Fuzzy Systems.
4. Gain knowledge about Fuzzy Logic Control design.
5. Build a Neural Network and Fuzzy control systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO NEURAL NETWORKS** Introduction to Artificial Neural Networks-Differences between biological and artificial neural networks - Typical architecture - Common activation functions - Learning Rules and Learning Methods of ANN - McCulloch-Pitts network - Perceptron - Single layer and Multi layer Feed forward network.	9
II	**NEURAL NETWORK ARCHITECTURES AND ALGORITHMS** Feedback networks - Back propagation neural net - Algorithm and Applications - Discrete time hop field networks - Self organising maps - Counter propagation - Architecture - Algorithm and applications - Adaptive Resonance Theory.	9
III	**INTRODUCTION TO FUZZY SYSTEMS** Introduction to Fuzzy logic - Properties and operations on classical sets and fuzzy sets - Crisp and fuzzy relations - Cardinality - Features of membership function - Standard forms and boundaries - Fuzzification - Membership value assignments - Lambda cuts for fuzzy sets and relations - De-fuzzification methods.	9
IV	**FUZZY LOGIC CONTROL** Membership function - Fuzzy Rules - Knowledge base - Rule base - Decision making logic - Fuzzy Inference system - Optimizations of membership function using neural networks - Adaptive fuzzy systems.	9
V	**APPLICATIONS OF NEURAL NETWORKS AND FUZZY LOGIC** Applications of neural networks: Pattern recognition - Image compression – Communication - Control systems - Applications of fuzzy logic: Fuzzy pattern recognition - Fuzzy image compression - Fuzzy logic controllers.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Infer the concepts of feed forward neural networks.
CO2:Summarize the various Neural Networks Architectures and its training Algorithms
CO3:Discover the concept of fuzziness involved in various systems and fuzzy set theory.
CO4:Implement the fuzzy logic control mechanism and adaptive fuzzy logic systems for suitable control problems.
CO5: Design the Neural Network/Fuzzy Logic Control to any real time applications.

TEXT BOOKS:

T1 - LaureneFausett, Englewood cliffs, N.J., “Fundamentals of Neural Networks”, PearsonEducation, New Delhi, 2008.
T2 - Timothy J Ross, “Fuzzy Logic with Engineering Applications”, John Willey and Sons, West Sussex, England, 2005.

REFERENCE BOOKS:

R1 - Kosko, B, “Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence”, PrenticeHall, NewDelhi, 2004.
R2 - Zimmerman H.J., “Fuzzy set theory and its Applications”, Allied Publishers Limited, 2001.
R3 - Jack M. Zurada, “Introduction to Artificial Neural Systems”,PWS Publishing Co., Boston, 2002.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16EI7402	Electrical Energy Management	3	0	0	3

Course Objective

1. Availability of Renewable Energy sources.
2. Understand and analyze the energy conservation.
3. Concepts of energy management system and role of energy manager.
4. Skills and techniques required to implement energy audit
5. Techniques required to implement energy audit in various applications

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ENERGY SOURCES** General – Energy consumption as a measure of prosperity – World energy futures – Energy sources and their availability – Renewable energy sources – Types – Prospects of renewable energy sources.	9
II	**ENERGY CONSERVATION** Introduction – Load curve – cost of electrical energy – need for electrical energy conservation methods – Power factor improvement – concept of distributed generation – Deregulation – Need for Restructuring. Indian Energy Conservation Act – BEE star rating - List of Energy Intensive Industries - Rules for Efficient Energy Conservation.	9
III	**ENERGY MANAGEMENT** Definition and objectives of energy management – Energy management strategy – Key elements – Responsibility and duties of energy manager – Energy efficient programs – Energy monitoring systems – Importance of SCADA – Analysis technique.	9
IV	**ENERGY AUDIT** Aim of Energy audit – Energy flow diagram – Strategy of energy audit – comparison with standards – Energy management team – Considerations in implementing energy conservation programmes – Periodic progress review	9
V	**ENERGY AUDIT FOR VARIOUS APPLICATIONS** Types of Energy Audit : Internal Audit, External Audit, Walk through Energy Audit, Preliminary Energy Audit, Detailed Energy Audit, Residential Energy Audit. Instruments for energy audits - Energy audit for Illumination system – Electrical system – Heating – Ventilation – Air conditioning system - Buildings – Economic analysis.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Illustrate the working of different non conventional energy sources.
CO2: Outline the importance of energy conservation and aware of energy conservation act.
CO3: Identify the role and responsibilities of energy manager.
CO4: Outline the fundamentals of energy audit.
CO5: Implement energy audit for several applications.

TEXT BOOKS:

T1- B.R. Gupta, " Generation of Electrical Energy " , S.Chand Publications , New Delhi , 2014.
T2- S. Sivanagaraju," Generation and Utilization of Electrical Energy " Pearson Education, New Delhi , 2010.

REFERENCES:

R1- G.D.Rai, " Non Conventional Energy Sources " , Khanna publishers , New Delhi , 2014.
R2- W.C. Turner, "Energy Management Handbook", 6th Edition, CRC press, 2006.
R3- L.C. Witte, P.S. Schmidt, D.R. Brown "Industrial Energy Management and Utilization", Hemisphere Publishing Corp., New York 1988.

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ELECTRONICS AND COMMUNICATION ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16EC6401	CONSUMER ELECTRONICS	3	0	0	3

Course Objective

1. Knowledge of various electronic audio and video devices and systems
2. To introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices like home appliances, audio – visual and communication systems.
3. To learn fault identification and rectification
4. To learn how to select the product by the way of comparing commercially available product.
5. To learn television concepts and their standards

Unit	Description	Instructional Hours
I	**LOUDSPEAKERS AND MICROPHONES** Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones	9
II	**TELEVISION STANDARDS AND SYSTEMS** Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL, SECAM - Components of a Remote Control.	9
III	**OPTICAL RECORDING AND REPRODUCTION** Audio Disc – Processing of the Audio signal – read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems.	9
IV	**TELECOMMUNICATION SYSTEMS** Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems	9
V	**HOME APPLIANCES** Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems;Digital watch, Calculators, An electronic guessing game, Battery charger, Decorative Lighting, LCD tunes with alarm.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe audio and video systems
CO2: Identify the problems in real time applications
CO3: Knowledge of assembling, fault diagnosis and rectification in a systematic way
CO4: Choose the best consumer product in market based on the requirement.
CO5: Differentiate various television concepts and their standards

TEXT BOOKS:

T1- S.P.Bali, “Consumer Electronics”, Pearson Education, 2005.
T2- B.R. Gupta, “Consumer Electronics”, S.K. Kataria& Sons, 2014.

REFERENCE BOOKS :

R1- Ajay Sharma, Audio video and TV Engineering-Consumer Electronics, DhanpatRai and co.
R2- R.G. Gupta, Audio and Video systems, Tata McGraw Hill Publishing Co.Ltd.
R3- R. Gulati, Monochrome and Color Television, New Age International (P) Ltd, New Delhi.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16EC7402	Internet of Things	3	0	0	3

Course Objective

1. To understand the fundamentals of Internet of Things.
2. To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
3. To apply the concept of Internet of Things in the real world scenario
4. To model an IoT based system with specifications and requirements.
5. To construct a web based system using IoT

Unit	Description	Instructional Hours
I	**THE INTERNET OF THINGS: AN OVERVIEW** Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoTvs M2M.	9
II	**IOT DESIGN METHODOLOGY** IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.	9
III	**IOT WITH RASPBERRY PI** Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services	9
IV	**BUILDING IOT WITH GALILEO/ARDUINO** Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks	9
V	**STUDIES and ADVANCED TOPICS** Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe IoT with various tools.
CO2: Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
CO3: Develop web services to access/control IoT devices.
CO4: Deploy an IoT application and connect to the cloud.
CO5: Analyze applications of IoT in real time scenario

TEXT BOOKS:

T1- ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
T2- Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects
for Linux Programmers”, Apress, 2014.

REFERENCE BOOKS :

R1- Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
R2- Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.

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ELECTRICAL AND ELECTRONICS ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16EE6401	INDUSTRIAL AUTOMATION – PLC AND SCADA	3	0	0	3

Course Objectives

1. Discuss the basic concepts involved in Programmable Logic Controllers
2. Interpret the Programmable Logic Controllers programming concepts
3. Cite the applications of Programmable Logic Controllers
4. Outline the basics of SCADA
5. Articulate the various SCADA communications and its applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO PLC** An Overview – Parts of PLC – Principles of Operation – Hardware Components – I/O Section – Discrete I/O Modules – Analog I/O Modules – Specifications – CPU – Memory Types – Human Machine Interface (HMI) – Processor Memory Organization – Program Scan.	9
II	**PLC PROGRAMMING** Basics of Ladder Diagram – Mnemonic Programming Code - Fundamental PLC Programming – Advanced Programming Techniques - Wiring Techniques – Programming Using Timers And Counters.	9
III	**PLC INSTRUCTIONS AND APPLICATIONS** Program Control Instructions – Data Manipulation Instructions – Math Instructions – Sequencer And Shift Register – Motor Controls – Closed Loop And PID Control – Case Studies in PLC.	9
IV	**INTRODUCTION TO SCADA** Evolution – Definition – Architecture - Remote Terminal Units (RTU) -Master Terminal Units (MTU) – Sensors, Actuators And Wiring - Intelligent Electronic Devices (IED) - Operator Interface.	9
V	**SCADA COMMUNICATIONS AND APPLICATIONS** Fundamentals of SCADA Communications – Basics of SCADA Protocols: DNP3, IEC 60870-5 – Ethernet And TCP/IP Networks – Profibus – Foundation Fieldbus. Applications: Substation Automation - Petroleum Wellhead Pump Control – Water Purification System – Crane Control.	9
	Total Instructional Hours	45

Course Outcomes

CO1: Demonstrate the knowledge of Programmable Logic Controllers
CO2: Develop Programs using ladder diagram.
CO3: Correlate the applications of PLC in various domains.
CO4: Summarise the basic concepts involved in SCADA System.
CO5: Analyze about communication standards in SCADA.

TEXT BOOKS:

T1 - F.D. Petruzella, 'Programmable Logic Controllers', Tata Mc-Graw Hill, Third Edition, 2010.
T2 - Stuart A. Boyer, 'SCADA- Supervisory Control and Data Acquisition', TheInstrumentation, Systemsand
Automation (ISA) Society, USA, Third Edition, 2004.

REFERENCE BOOKS:

R1 - Ronald L.Krutz, 'Securing SCADA Systems', Wiley Publishing Inc.2006.
R2 - David Bailey, Edwin Wright, 'Practical SCADA for Industry' Newnes -ElsevierPublications, 2003.
R3 - Gordon Clarke, Deon Reynders, 'Practical Modern SCADA protocols', Newnes -Elsevier Publications, 2004.
R4 - John R.Hackworth, Frederick D.Hackworth, Jr, 'Programmable Logic Controllers: Programming Methods and
Applications', Prentice Hall Publications, First Edition, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16EE7402	LabVIEW for Engineering Applications	3	0	0	3

Course Objective

1. Infer the knowledge about virtual instrumentation.
2. Transform the conventional programming to data flow programming.
3. Discuss the various instrument interface and protocol.
4. Integrate the hardware with LabVIEW Programming via DAQ system.
5. Build the application via graphical programming knowledge.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Architecture of Virtual Instrumentation – Virtual Instruments Vs Traditional Instruments – Graphical System Design using LabVIEW-Conventional and Graphical Programming.	9
II	**GRAPHICAL PROGRAMMING AND LabVIEW** Concepts of graphical programming – LABVIEW software – Concept of VIs and sub VI - Loops - Structures - Arrays – Clusters-Local and global variables – String and file I/O.	9
III	**INSTRUMENT INTERFACES AND PROTOCOLS** RS232, RS422, RS485 and USB standards - IEEE 488 standard – Introduction to bus protocols of MOD bus and CAN bus.	9
IV	**DATA ACQUISITION (DAQ) AND INSTRUMENT CONTROL** Components of DAQ- Hardware components of DAQ -Analog I/O and Digital I/O- Configuration of DAQ -Instrument control: VISA, GPIB.	9
V	**ADVANCED LABVIEW APPLICATIONS** Applications of LabVIEW: Process control, Biomedical, Image acquisition and Processing, Power quality monitoring.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Interpret knowledge on virtual instrumentation using LabVIEW.
CO2: Perform the basic programming with LabVIEW palettes.
CO3: Outline concept of various instrument interfaces with LabVIEW.
CO4: Employ the role of DAQ concepts for interfacing hardware components.
CO5: Implementing the LabVIEW in various engineering application.

TEXT BOOKS:

T1 - Sanjay Gupta and Joseph John, “Virtual Instrumentation using LabVIEW”, Tata McGraw-Hill, Second Edition, 2010.
T2 - Jovitha Jerome, “Virtual Instrumentation using LabVIEW” Prentice Hall, 2010.

REFERENCE BOOKS :

R1 -Gary W. Johnson, Richard , “LabVIEW Graphical Programming”, Tata McGraw Hill Professional Publishing,2006.
R2 - Lisa K Wells & Jeffrey Travels, “LabVIEW for Everyone”, Prentice Hall, 2003.
R3 - Robert H. Bishop, “Learning with LabVIEW”, Prentice Hall, 2009.
R4 - Kevin James, “PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control”, Newnes -Elsevier Publications, 2000.

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INFORMATION TECHNOLOGY

Programme	Course Code	Name of the Course	L	T	P	C
BTECH	16IT6401	CYBER SECURITY AND FORENSICS	3	0	0	3

Course Objective

1. Learn the security issues Cryptographic Techniques.
2. Be exposed to security issues of the MALICIOUS Code.
3. Learn Cyber forensics.
4. Be familiar with forensics tools.
5. Learn to analyze and validate forensics data

Unit	Description	Instructional Hours
I	**INTRODUCTION: Cyber Security Fundamentals:** Network and Security Concepts, Basic Cryptography, Symmetric Encryption, Firewalls, Virtualization, Microsoft Windows Security Principles **Attacker Techniques and Motivations:** Proxies, Tunneling Techniques, Fraud Techniques, and Threat Infrastructure.	9
II	**MALICIOUS CODE: Malicious Code:** Self-Replicating Malicious Code, Evading Detection and Elevating Privileges, Stealing Information and Exploitation D**efe**n**se** a**nd A**na**lysis** T**ech**n**iques:** Memory Forensics, Honeypots, Malicious Code Naming, Automated Malicious Code Analysis Systems, Intrusion Detection Systems.	9
III	**INTRODUCTION TO CYBER FORENSICS:** The Goal of the Forensic Investigation: Why Investigate, Internet Exceeds Norm, How to Begin a Non−Liturgical Forensic Examination: Isolation of Equipment, Cookies, Cache, How to Correlate the Evidence, The Liturgical Forensic Examination: Tracing Activity on a Windows−Based Desktop, The Microsoft Windows−Based Computer.	9
IV	**EVIDENCE COLLECTION AND FORENSICS TOOLS:** Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9
V	**ANALYSIS AND VALIDATION:** Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the security issues in Cryptographic Techniques.
CO2: Apply security principles in the MALICIOUS Code.
CO3: Gain knowledge aboutcyber forensics.
CO4: To analyze digital evidence and use forensics tools.
CO5: Explain the principle of Network Forensics.

TEXT BOOKS:

T1 - James Graham, Richard Howard, Ryan Olson, “Cyber Security Essentials” CRC Press, Taylor and Francis Group, 2011.
T2 - Albert J. Marcella, Robert S. Greenfield “Cyber Forensics—A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, AUERBACH Publications, 2002

REFERENCE BOOKS :

R1 -John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
R2 - Richard E.Smith, “Internet Cryptography”, 3rd Edition Pearson Education, 2008.
R3 - MarjieT.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3rd Edition, Prentice Hall,2013.

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Programme	Course Code	Name of the Course	L	T	P	C
BTECH	16IT7402	ARTIFICIAL INTELLIGENCE	3	0	0	3

Course Objective

1. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
2. Study the concepts of Artificial Intelligence.
3. Learn the methods of solving problems using Artificial Intelligence.
4. Implement a small AI system in a team environment.
5. Introduce the concepts of Expert Systems and Machine learning.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE** Meaning and definition of artificial intelligence, Various types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. A* algorithm, AO* algorithms etc, and various types of control strategies.	9
II	**REPRESENTATION OF KNOWLEDGE** Game playing- Knowledge representation-Knowledge representation using propositional and predicate logic-Comparison of propositional and predicate logic-Resolution, Refutation.	9
III	**KNOWLEDGE INFERENCE** Knowledge representation-Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory	9
IV	**PLANNINGAND MACHINE LEARNING** Basic plan generation systems – Strips - Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.	9
V	**EXPERT SYSTEMS** Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Identify problems that are amenable to solution by AI methods.
CO2: Identify appropriate AI methods to solve a given problem.
CO3: Formalise a given problem in the language/framework of different AI methods.
CO4: Implement basic AI algorithms.
CO5: Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

TEXT BOOKS:

T1-Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008.(Units- ,II,VI&V)
T2-Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.(Unit-III).

REFERENCE BOOKS :

R1-Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education 2013.
R2-Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

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MECHANICAL ENGINEERING

Programme	Course Code	Name of the Course	L	T	P	C
BE	16ME7402	Composite Materials for Engineering	3	0	0	3

Course Objective

1. Review physics and chemistry in the context of materials science & engineering.
2. understand the manufacturing processes of reinforcement fibers and matrices for composites
3. Introduce students to the concepts of composite materials
4. Equip them with knowledge of applications and selection of different composites in consideration of the properties and characteristics
5. Equip them with knowledge on how to fabricate and carry out standard mechanical test on composites.

Unit	Description	Instructional Hours
I	**Basics of Fibers, Matrices and Composites:** Basics of fibers, matrices and composites: Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Fiber surface treatments, Fillers and Additives.	9
II	**Manufacturing:** Bag molding – Compression molding – Pultrusion – Filament winding – Resin film infusion - Elastic reservoir molding - Tube rolling – Quality inspection methods. Processing of metal matrix composites (MMC) – Diffusion bonding – Stir casting – Squeeze casting.	9
III	**Performance:** Static mechanical properties – Fatigue and impact properties – Environmental effects – Long term properties, Fracture behavior and Damage tolerance.	9
IV	**Mechanics:** Fiber content, density and void content. Rule of mixture -Volume and mass fractions – Density - Void content, Evaluation of four elastic moduli based on strength of materials approach and semi-empirical model-Longitudinal Young‘s modulus-Transverse Young‘s modulus–Major Poisson‘s ratio-In-plane shear modulus, Ultimate strengths of a unidirectional lamina. Characteristics of Fiber-reinforced lamina–Laminates–Lamination theory.	9
V	**Design:** Failure Predictions, Laminate Design Consideration-Design criteria-Design allowable -Design guidelines, Joint design-Bolted and Bonded Joints, Design Examples-Design of a tension member – Design of a compression member – Design of a beam-Design of a torsional member, Application of Finite element method (FEM) for design and analysis of laminated composites.	9
	Total Instructional Hours	**45**

Course Outcome

Student upon completion of the course shall be able to:

CO1 :Demonstrate the knowledge on the fundamentals of fibers, matrices and composites
CO2:Portray the various manufacturing processes involved in the fabrication of composite material
CO3:Demonstrate knowledge on the performance of composite materials
CO4:Understand and solve problems concerning the mechanics of composite materials
CO5:Perform design calculations for the development of fiber reinforced matrics

TEXT BOOKS:

T1 Mallick P.K., ―Fiber Reinforced Composites: Materials, Manufacturing and Design, 3rd Edition, Taylor and Francis, 2008.
T2 Autar K. Kaw, ―Mechanics of Composite Materials‖, 2nd Edition, CRC Press, 2006.

REFERENCE BOOKS:

R1 Bhagwan D. Agarwal, Lawrence J. Broutman, Chandrashekhar K., ―Analysis and Performance of Fiber Composites‖, 3rd Edition, John Wiley & Sons, New York, ISBN: 978-0-471-26891-8, June 2006.
R2 Gibson R.F., ―Principles of Composite Material Mechanics", 3rd Edition, CRC Press, 2011.
R3 Chawla K.K., ―Composite Materials‖, 3rd Edition, Springer – ISBN: 978-0-387-74364-6 Verlag, Boston, 2012

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Programme	Course Code	Name of the Course	L	T	P	C
BE	16ME6401	Rapid Prototyping and Lean Manufacturing	3	0	0	3

Course Objective

1. Understand the complex interrelationships between design and manufacturing
2. Explore and understand basic manufacturing processes and the design for manufacturing (DFM) implications of design choices for specific manufacturing processes
3. Use assembly considerations and assembly costs in evaluations
4. Learn modern manufacturing philosophies and practices
5. Understand the role of software applications in evaluating designs for manufacturing and assembly costs

Unit	Description	Instructional Hours
I	**INTRODUCTION** Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping – Virtual prototyping	7
II	**LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS** Stereo lithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.	10
III	**POWDER BASED RAPID PROTOTYPING SYSTE** Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, LaserEngineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes,materials, products, advantages, applications and limitations – Case Studies.	10
IV	**LEAN MANUFACTURING** Origin of lean production system – Customer focus – Muda (waste) – Standards – 5S system – Total Productive Maintenance – standardized work –Man power reduction – Overall efficiency - Kaizen – Common layouts - Principles of JIT - Jidoka concept – Poka-Yoke (mistake proofing) - Worker Involvement– Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Lean culture.	9
V	**JUST IN TIME** Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties – flexible work force - line flow strategy - preventive maintenance - Kanban system - strategic implications - implementation issues - Lean manufacture.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of this course, the students can be able to

CO1:Compare different methods and discuss the effects of the Rapid Prototyping technologies.

CO2:Analyse the characteristics of the different processing Lean Manufacturing.

CO3:Learn a systematic procedure to analyze a proposed design from the point of view of assembly and manufacturing.

CO4:Describe the current available rapid prototyping systems, their fundamental operating principles, and their characteristics

CO5:Describe complementary, secondary fabrication processes commonly used with the above rapid prototyping systems

TEXT BOOKS

T1- Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., andLim C.S., World Scientific Publishers, 2003.

T2-Rapid Tooling: Technologies and Industrial Applications, Peter D.Hilton, Hilton/Jacobs, PaulF.Jacobs, CRC press, 2000.

REFERENCE BOOKS

R1-Rapid Prototyping and Engineering applications: A tool box for prototype development, LiouW.Liou, Frank W.Liou, CRC Press, 2007.

R2- TaiichiOhno, Toyota, “Production System beyond Large-Scale production Productivity Press(India) Pvt.Ltd. 1992

R3- Rapid Prototyping: Theory and practice, Ali K. Kamrani, EmadAbouel Nasr, Springer, 2006.

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MECHATRONICS ENGINEERING

Programme	Course code	Name of the course	L	T	P	C
BE	16MT7402	Hybrid Vehicles System	3	0	0	3

Course Objective

1. To summarize the developments of electrical vehicles
2. To discuss the hybrid vehicles design considerations
3. To extend design consideration to ancillary systems
4. To familiarize battery and novel energy sources
5. To learn about electric vehicle modelling

Unit	Description	Instructional hours
I	**INTRODUCTION** Electrical Vehicle Systems - History of Electric Vehicles - Components- Social and Environmental Importance of Hybrid and Electric Vehicles -Types of Electric Vehicle in use Today - Electric Vehicles for the Future.	9
II	**HYBRID VECHICLE DESIGN CONSIDERATIONS** Introduction - Aerodynamic Considerations - Consideration of Rolling Resistance- Transmission Efficiency - Consideration of Vehicle Mass - Electric Vehicle Chassis and Body Design - General Issues in Design.	9
III	**DESIGN OF ANCILLARY SYSTEMS** Introduction - Heating and Cooling Systems - Design of the Controls- Power Steering - Choice of Tyres - Wing Mirrors, Aerials and Luggage Racks - Electric Vehicle Recharging and Refuelling Systems.	9
IV	**BATTERY AND NOVEL ENERGY SOURCES** Introduction - Battery Parameters - Lead Acid Battery - Nickel Based Batteries - Sodium based Batteries - Lithium Batteries - Battery Charging - Use of Battery in Hybrid Vehicle Fuel Cell Based Energy Storage, Solar Photovoltaic - Wind Power - Flywheels - Super Capacitors - Supply Rails.	9
V	**ELECTRIC VEHICLE MODELLING AND CASE STUDIES** Introduction - Tractive Effort - Modelling Vehicle Acceleration - Modelling Electric Vehicle Range. Case Studies: Rechargeable Battery Vehicles - Hybrid Vehicles - Fuel Cell Powered Bus.	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Classify Electric Vehicle and its components
CO2: Calculate the vehicles design considerations
CO3: Develop the ancillary systems and its design
CO4: Compare various energy storage devices and energy sources
CO5: Conclude the performance of the electrical vehicle using modelling

TEXT BOOKS:

T1- James Larminie, "*John Lowry, Electric Vehicle Technology Explained*", 2nd Edition, John Wiley & Sons, 2012.
T2- Iqbal Hussein, "*Electric and Hybrid Vehicles: Design Fundamentals*", 2nd Edition, CRC Press, 2011.

REFERENCE BOOKS:

R1- MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, "*Modern Electric,Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*", 2nd Edition, CRC Press, 2009.
R2- Thomas J., Frank**,** Benjamin, "*Hybrid Systems, Optimal Control and Hybrid Vehicles*", 1st Edition, Springer International Publishing, 2017.

Dr. K. AKIL	
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Programme	CourseCode	Name of the course	L	T	P	C
BE	16MT6401	Industrial Safety and Environment	3	0	0	3

Course Objective

1. To impart knowledge about the fundamentals of safety, Health and Environment
2. To provide knowledge in different safety organizations
3. To impart awareness about the Work Safety in industry
4. To understand the industrial safety and Ergonomics in work area
5. To impart awareness about the Environment Management

Unit	Description	Instructional hours
I	**INTRODUCTION** Need for Integration of Safety, Health and Environment - Fundamentals of Safety - Factory Act 1948 - Process Safety Management - Civilizations and Safety Requirements - Economic Aspects - Elements of Safety Programming - Safety versus Health.	9
II	**SAFETY ORGANIZATION** Introduction - Purpose of a Safety Organization - Classification of Accidents - Safety and Government Role - National Safety Council - Safety Act - Provisions for Worker Welfare - Workmen Compensation Act 1943 - Safety and Security Measures - Management Safety Policy - Safety Auditing - Maintenance and Safety - Security Management of Industrial Plants.	9
III	**SAFE WORKING AND HAZARDS** Introduction - Work Place Safety - Safe Working Environment - Fire safety Instructions - Safety Devices and Tools - Safety Instruction - Maintenance - Electricity - Welding - Hand Tools - Safety Measures for Compressed System and Cylinders - Personal Safety - Permit to Work System - Personal Protection Equipment (PPE) - Concepts of Hazard Avoidance - Hazard Classification Scale.	9
IV	**INDUSTRIAL SAFETY AND ERGONOMICS** Introduction - Safety Training - Hazard Check List - General Safety Rules - Human Factors in Machine Equipment Safety - Fire Prevention - Accident Prevention - Principles of Safe Machine Design - Safety in Materials Handling and Storage - General Safety Rules - Roles of OSHA - Facets of Ergonomics - Ergonomics Standards - Ergonomic Risk Analysis - Sources of Ergonomic Hazards.	9
V	**ENVIRONMENTAL MANAGEMENT AND CASE STUDIES** Environment Protection Act - National Environment Policy - Environmental Standards - Degradation of Environment - Environment Management System - ISO 14000 - International Environmental Principles - Environmental Protection Agency - Environmental Impact Assessment -Case study on Machines and Equipment - Handling of Equipment.	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Identify the evaluation of industrial safety, health and environmental standards
CO2: Describe the types of accidents and safety measures
CO3: Interpret the safety working procedure of different work area
CO4: Apply ergonomics for safety working procedure for humans in industrial area
CO5: Identify the needs of Environmental Management for sustainable development

TEXT BOOKS:

T1- R.K Jain, *"Industrial Safety, Health and Environment Management System"*, 4th Edition Khanna publishers, 2015.
T2- R.K. Mishra, *"Safety Management"*, 2nd Edition AITBS publishers, 2012.

REFERENCE BOOKS:

R1- C. Ray Asfahl, David W. Rieske*" Industrial Safety and Health Management"*, 6th Edition, Pearson Higher Education,2010.
R2- Krishnan N.V., *"Safety in Industry"*, 2nd Edition, Jaico Publisher House, 2005.
R3- L.M Deshmukh, *"Industrial Safety Management and Risk control"*, 1st Edition, McGraw Hill Education.

Dr. K. AKIL	
Signature and Name of the Chairman, BOS	**Principal / Dean (Academics)**

MASTER OF COMPUTER APPLICATION

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CAX4XX	Network Security	3	0	0	3

Course Objective

11. Understand security concepts, Understand security threats.
12. Comprehend and apply relevant cryptographic techniques.
13. Comprehend and apply authentication services and mechanisms.
14. Comprehend and apply email security services and mechanisms.
15. Comprehend and apply web security services and mechanisms.

Unit	Description	Instructional Hours
I	**SECURITY SERVICES** Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services and Mechanisms - A model for Internetwork security - Buffer overflow & format string vulnerabilities - TCP session hijacking - route table modification, man-in-the-middle attacks.	9
II	**ALGORITHMS AND HASHING** Encryption Principles - Encryption algorithms - cipher block modes of operation - key distribution Approaches of Message Authentication - Secure Hash Functions and HMAC.	9
III	**KEY MANAGEMENT** Public key cryptography principles - algorithms, digital signatures - digital Certificates - Certificate Authority and key management Kerberos - X.509 Directory Authentication Service.	9
IV	**IP SECURITY** Email privacy: Pretty Good Privacy (PGP) and S/MIME. IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associationsand Key Management**.**	9
V	**IDS** Viruses and related threats, Intruders, Firewall Design principles, Trusted Systems. Intrusion DetectionSystems**.**	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand security attacks and services.
CO2: Explain different cryptographic algorithms
CO3: Gain knowledge aboutdigital signatures and key management.
CO4: To state IP security and mail privacy.
CO5: Explain issues related to the security of web services.

REFERENCE BOOKS :

R1 - Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
R2 - Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech
R3- Cryptography and network Security, Third edition, Stallings, PHI/Pearson

Dr. K. AKIL	
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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CAX4XX	Principles of Cloud Computing	3	0	0	3

Course Objective

1. Understand the components of cloud computing.
2. Evaluate information storage managementdesign in a cloud environment
3. Discuss data centre networking technologies and protocols.
4. Assess the security of virtual systems.
5. Discuss and evaluate the management of complex virtual environments.

Unit	Description	Instructional Hours
I	**CLOUD COMPUTING FUNDAMENTALS** Cloud Computing definition - private, public and hybrid cloud - Cloud types - IaaS, PaaS, SaaS - Benefits and challenges of cloud computing - public vs private clouds - role of virtualization in enabling the cloud - Benefits and challenges to Cloud architecture - security and disaster recovery.	9
II	**CLOUD STORAGE INFRASTRUCTURES** Architecture of storage, analysis and planning - Storage network design considerations - NAS and FC SANs - hybrid storage networking technologies - design for storage virtualization in cloud computing.	9
III	**EVOLUTION OF DATA CENTRE DESIGN** Design for flexibility – scalability - environmental control - electrical power – flooring - fire protection – security - network infrastructure - Energy use and greenhouse gas emissions - Requirements for modern data centers - high availability and Service Orientated Infrastructures (SOI).	9
IV	**MULTI-TENANCY ISSUES** Isolation of users/VMs from each other - Virtualization System Security Issues ESX file system security - storage considerations - backup and recovery - Virtualization System Vulnerabilities - Management server vulnerabilities - hypervisor vulnerabilities - configuration issues - malware (botnets etc).	9
V	**PERFORMANCE MANAGEMENT IN A VIRTUAL ENVIRONMENT** Management techniques - methodology and key performance metrics usedto identifying CPU, memory, network - virtual machine and application performance bottlenecks in a virtualized environment.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand cloud computing fundamentals.
CO2: Explain different storage network designs.
CO3: State network centre designs.
CO4: Describe virtualization vulnerabilities.
CO5: Explain virtual machine performance and its bottlenecks.

REFERENCE BOOKS :

R1 - Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach
R2 - Greg Schulz 2011, Cloud and Virtual Data Storage Networking, Auerbach Publications
R3 - Tim Mather, SubraKumaraswamy, ShahedLatif,
Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance

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