JNTUH COLLEGE OF ENGINEERING HYDERABAD
(AUTONOMOUS)
B.Tech. 5 year (10 semesters) Integrated Dual Degree Programme (IDP)
[Leading to B.Tech. & M.Tech. / MBA)] in
COURSE STRUCTURE (for NON CIRCUIT BRANCHES)
(Applicable from the batch admitted from the Academic Year 2015-2016 and onwards)

I YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	BS	Mathematics - I	4	1	0	4
2	BS	Engineering Physics	3	1	0	3
3	BS	Applied Chemistry	3	1	0	3
4	ES	Computer Programming & Data Structures	4	1	0	4
5	ES	Applied Mechanics	4	1	0	4
6	BS	Engineering Physics Lab	0	0	3	2
7	BS	Applied Chemistry Lab	0	0	3	2
8	ES	Computer Programming & Data Structures Lab	0	0	3	2
		NSS/NCC/NSO				
		Total Credits				**24**

I YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	BS	Mathematics–II	3	1	0	3
2	ES	Fundamentals of Electrical & Electronics Engineering	3	0	0	3
3	HS	English	3	0	0	3
4	ES	Engineering Graphics	3	0	3	4
5	ES	Environmental Science	3	0	0	3
6	BS	Computational Mathematics	2	0	0	2
7	ES	Engineering Workshop	0	0	3	2
8	HS	English Language Communication Skills Lab	0	0	3	2
9	BS	Computational Mathematics Lab	0	0	3	2
		NSS/NCC/NSO				
		Total Credits				**24**

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II YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	BS	Probability & Statistics	4	1	0	3
2	PC	Strength of Materials – I	4	1	0	4
3	ES	Building Materials, Construction & Planning	4	0	0	3
4	ES	Surveying	4	1	0	4
5	PC	Fluid Mechanics	4	1	0	3
6	PC	Computer Aided Drafting Lab – I	0	0	3	2
7	PC	Strength of Materials Lab	0	0	3	1
8	ES	Surveying Lab-I	0	0	3	2
9	HS	Human Values and Professional Ethics	2	0	0	2
		Total Credits				**24**

II YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PC	Strength of Materials – II	4	1	0	4
2	PC	Hydraulics & Hydraulic Machinery	4	1	0	4
3	PC	Structural Analysis – I	4	1	0	4
4	ES	Engineering Geology	4	0	0	3
5	PC	Environmental Engineering	4	1	0	4
6	HS	Gender Sensitization Lab	-	-	-	-
7	ES	Engineering Geology Lab	0	0	3	1
8	PC	Environmental Engineering Lab	0	0	3	2
9	PC	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	2
		Total Credits				**24**

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III YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	OE-I	Open Elective – I	3	0	0	3
2	HS	Managerial Economics and Financial Analysis	4	0	0	4
3	PC	Design of Reinforced Concrete Structures	3	1	1	4
4	PC	Soil Mechanics	4	1	0	4
5	PC	Water Resources Engineering - I	3	1	0	3
6	HS	Advanced English Language Communication Skills Lab	0	0	3	2
7	PC	Surveying Lab- II	0	0	3	2
8	PC	Geotechnical Engineering Lab	0	0	3	2
9		**Total Credits**				**24**

III YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	OE-II	Open Elective – II	3	0	0	3
2	PE	Professional Elective – I	4	0	0	4
3	PE	Professional Elective – II	4	0	0	4
4	PC	Design of Steel Structures	3	1	1	4
5	PC	Transportation Engineering	4	1	0	4
6	PC	Transportation Engineering Lab	0	0	3	2
7	ES	Computer Aided Drafting Lab-II	0	0	3	1
8	PC	Concrete Technology Lab	0	0	3	2
		Total Credits				**24**

Professional Elective 1

1. Concrete Technology
2. Air Pollution and Control
3. Ground Water Development & Management
4. Introduction to offshore structures

Professional Elective 2

1. Structural Analysis-II
2. Stochastic Hydrology
3. Geo Environmental Engineering
4. FEM for Civil Engineering

Professional Elective 3

1. Water Resources Engineering – II
2. Traffic Engineering
3. Bridge Engineering
4. Soil Dynamics and Machine Foundations

OPEN ELECTIVE- I		
S.No.	**Subject**	**Offering Department**
1	Disaster Management	Civil Engineering
2	Non – Conventional Power Generation	Electrical & Electronics Engineering
3	Electrical Engineering Materials	
4	Nano-Technology	
5	Operations Research	Mechanical Engineering
6	Basics of Thermodynamics	
7	Fabrication Processes	
8	Electronic Measuring Instruments	Electronics & Communication Engineering
9	OOPS through JAVA	Computer Science & Engineering
10	Computer Graphics	
11	Engineering Materials	Metallurgical Engineering
12	Metallurgy for Non Metallurgists	
13	Industrial Pollution Control Engineering	Chemical Engineering

OPEN ELECTIVE- II		
S.No.	**Subject**	**Offering Department**
1	Estimation, Quantity Survey & Valuation	Civil Engineering
2	Design Estimation and Costing of Electrical Systems	Electrical & Electronics Engineering
3	Energy Storage Systems	
4	Mechatronics	
5	Jet propulsion and Rocket Engineering	Mechanical Engineering
6	Ergonomics	
7	Mechatronics	
8	Principles of Electronic Communications	Electronics & Communication Engineering
9	Cyber Security	Computer Science & Engineering
10	Database Management Systems	
11	Corrosion Engineering	Metallurgical Engineering
12	Testing of Materials	
13	Solid Waste Management	Chemical Engineering

OPEN ELECTIVE- III		
S.No.	**Subject**	**Offering Department**
1	Environmental Impact Assessment	Civil Engineering
2	Entrepreneur Resource Planning	Electrical & Electronics Engineering
3	Management Information Systems	
4	Organizational Behavior	
5	Fundamentals of Robotics	Mechanical Engineering
6	Non-Conventional Energy Sources	
7	Aspects of Heat Transfer in Electrical/Electronically controlled units	
8	Principles of Computer Communications and Networks	Electronics & Communication Engineering
9	Web technologies	Computer Science & Engineering
10	Simulation & Modeling	
11	Surface Engineering	Metallurgical Engineering
12	Nano Materials	
13	Industrial Safety & Hazard Management	Chemical Engineering

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IV YEAR I SEMESTER

S.No.		Group	Subject	L	T	P	Credits
1	Theory	PC	Finite Element Methods	4	1	0	4
2	Theory	PE-III (UG)	Professional Elective –III	4	1	0	4
3	Theory	PG	PG Core-I (Theory of Elasticity)	4	1	0	4
4	Theory	PG	Elective - I	4	1	0	4
5	Theory	PG	Elective -II	4	1	0	4
6	Theory	PG	Elective -II	4	1	0	4
7	Practical / Lab	PC	UG Lab - GIS Lab	0	0	3	2
8	Practical / Lab	PGC	PG Lab - 1-CAD Lab (Staad)	0	0	4	2
9	Project	UG	Industrial Training / Mini Project (summer program)	0	0	0	2
6 Theory + 2 Labs			Total Credits				30

IV YEAR II SEMESTER

S.No.		Group	Subject	L	T	P	Credits
1	Theory	HSS (UG)	Management Science	4	0	0	4
2	Theory	PG	PG Core - II Structural Dynamics	4	1	0	4
3	Theory	PG	PG Elective - IV	4	1	0	4
4	Practical / Lab	PG	PG Lab - II Advanced Concrete Lab	0	0	4	2
5	Project	UG	Major Project	0	0	0	14
			Total Credits				28

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V YEAR I SEMESTER

S.No.		Group	Subject	L	T	P	Credits
1	Theory	PG	PG Core - III Analysis of Plates and Shells	4	1	0	4
2	Theory	PG	PG Elective - V	4	1	0	4
3	Theory	PG	PG Elective - VI	4	1	0	4
4	Theory	PG	PG Elective - VII	4	1	0	4
5	Project		PG Project - Stage I				12
6	Seminar		Seminar	0	0	3	2
			Total Credits				30

V YEAR II SEMESTER

S.No.		Group	Subject	L	T	P	Credits
1	Project	PG	PG Project - Stage II				18
2	Viva	PG	Comprehensive Viva				4
			Total Credits				22

JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	3

PROBABILITY AND STATISTICS

Pre Requisites: Mathematic - I

Objectives: To make the student to understand the statistics and probability theories such as random variables, sampling distribution, tests of significance etc. so that he can apply them to engineering problems.

Outcomes: Students will able to perform probability theories & statistics on engineering problems

UNIT-I: Probability

Sample space and events – Probabilty – The axioms of probability – Some Elementary theorems – Conditional probability – Baye,s theorem, Random variables – Discrete and continuous**.**

UNIT-II: Single Random variables and probability distributions

Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution . Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.
Binomial , Poisson & normal distributions and their properties . Moment generating functions of the above three distributions. and hence finding the mean and variance.

UNIT-III: Multiple Random variables, Correlation & Regression

Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables, Correlation -Coefficient of correlation, The rank correlation.
Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

UNIT-IV: Sampling Distributions and Testing of Hypothesis

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and varience, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of varience.
Parameter estimations – likelihood estimate, interval estimations .
Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, Two sided test,

Large sample tests:

(i)Test of Equality of means of two samples equality of sample mean and population mean (cases of known varience & unknown varience, equal and unequal variances)

(ii) Tests of significance of difference between sample S.D and population S.D.

(iii)Tests of significance difference between sample proportion and population proportion&difference between two sample proportions.

Small sample tests:
Student t-distribution,its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples
Snedecor's F- distribution and it's properties. Test of equality of two population variences
Chi-square distribution , it's properties, Chi-square test of goodness of fit

UNIT- V: Queuing Theory & Stochastic Processes
Arrival Theorem – Pure Birth process and Death process M/M/1 Model. Introduction to Stochastic Processes – Markov process classification of states – Examples of Markov Chains, Stochastic Matrix, limiting probabilities.

Text Books:

1) FUNDAMENTALS OF MATHEMATICAL STATISTICS BY S C GUPTA AND V.K.KAPOOR
2) PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS BY SHELDON M.ROSS,ACADEMIC PRESS
3) PROBABILITY AND STATISTICS FOR ENGINEERING AND THE SCIENCEC BY JAY L.DEVORE.

References:

1) MATHEMATICS FOR ENGINEERS SERIES –PROBABILITY STATISTICS AND STOCHASTIC PROCESS BY K.B.DATTA AND M.A S.SRINIVAS,CENGAGE PUBLICATIONS
2) PROBABILITY, STATISTICS AND STOCHASTIC PROCESS BY PROF.A R K PRASAD., WIELY INDIA
3) PROBABILITY AND STATISTICS BY T.K.V.IYENGAR &B.KRISHNA GANDHI etel
4) A TEXT BOOK OF PROBABILITY AND STATISTICS, SHAHNAZ BATHUL , CENGAGE LEARNING

JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

STRENGTH OF MATERIALS - I

Pre Requisites: Engineer Mechanics

Objectives: The subject provide the knowledge of simple stress strains flexural stresses in members, shear stresses and deflection in beams so that the concepts can be applied to the Engineering problems.

Outcomes: Student can able to find out the bending moments, shear force diagram shear stresses and deflection in beams to the engineering problems

UNIT – I
SIMPLE STRESSES AND STRAINS:
Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic modulii and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Elastic constants.
STRAIN ENERGY – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II
SHEAR FORCE AND BENDING MOMENT :
Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilver, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – Point of contraflexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III
FLEXURAL STRESSES:
Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES :
Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV
DEFLECTION OF BEAMS :
Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, Uniformly varying load-Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

CONJUGATE BEAM METHOD: Introduction – Concept of conjugate beam method. Difference between a real beam and a conjugate beam. Deflections of determinate beams with constant and different moments of inertia.

UNIT – V

PRINCIPAL STRESSES AND STRAINS :

Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

THEORIES OF FAILURE: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Maximum shear stress theory- Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

Text Books:

1) Strength of Materials by R.K.Bansal, Lakshmi Publications House Pvt. Ltd.
2) Strength of Materials by R.K Rajput, S.Chand & Company Ltd.

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References:

1) Strength of Materials by S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
2) Mechanics of Structures Vol –I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
3) Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
4) Strength of Materials by S.S.Rattan, Tata McGraw Hill Education Pvt. Ltd.
5) Fundamentals of Solid Mechancis by M.L.Gambhir, PHI Learning Pvt. Ltd
6) Strength of Materials and Structures by John Case *et al.*, Butterworth-Heinemann.
7) Strength of Materials by R.Subramanian, Oxford University Press.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	0	0	3

BUILDING MATERIALS, CONSTRUCTION AND PLANNING

Pre Requisites: Engineering Mechanics

Objectives: To give the students a basic idea about the construction materials, building components and to introduce component methodologies.

Outcomes: Student able to identify various building materials to perform construction & planning

UNIT – I

Stones and Bricks, Tiles:

Building stones – classifications and quarrying – properties – structural requirements – dressing

Bricks – Composition of Brick earth – manufacture and structural requirements.

Wood, Aluminum, Glass and Paints

Wood - structure – types and properties – seasoning – defects; alternate materials for wood – GI / fibre – reinforced glass bricks, steel & aluminum.

UNIT-II

Cement & Admixtures :

Ingredients of cement – manufacture – Chemical composition – Hydration - field & lab tests

Admixtures – mineral & chemical admixtures – uses.

UNIT-III

Building Components :

Lintels, Arches, walls, vaults – stair cases – types of floors, types of roofs – flat, curved, trussed ; foundations – types ; Damp Proof Course ; Joinery – doors – windows – materials – types.

Building Services :

Plumbing Services : Water Distribution, Sanitary – Lines & Fittings ; Ventilations : Functional requirements systems of ventilations. Air-conditioning - Essentials and Types ; Acoustics – characteristic – absorption – Acoustic design ; Fire protection – FireHarzards – Classification of fire resistant materials and constructions

UNIT -IV

Masonry and Finishing's

Brick masonry – types – bonds ; Stone masonry – types ; Composite masonry – Brick-stone composite ; Concrete, Reinforced brick.

Finishers : Plastering, Pointing, Painting, Claddings – Types – Tiles - ACP

Form work :

Requirements – Standards – Scaffolding – Design ; Shoring, Underpinning.

UNIT –V

Building Planning : Principles of Building Planning, Classification of buildings and Building by laws.

TEXT BOOKS:

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications
2. Building Construction by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi

REFERENCES:

1. Building Materials by Duggal, New Age International.
2. Building Materials by P.C.Varghese, PHI.
3. Building Construction by PC Varghese PHI.
4. Construction Technology – Vol – I & II by R. Chuddy, Longman UK.
5. Basics of Civil Engg by Subhash Chander; Jain Brothers
6. Alternate Building materials and Technology, K.S.Jagadish,Venkatarama Reddyand others; New Age Publications

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II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

SURVEYING

Pre Requisites: Engineering Mechanics

Objectives: The first step in engineering practice is surveying and the soundness of the any civil engineering work is dependent on the reliability and accuracy of the surveying. There fore, it is imperative that a student of engineering should have good knowledge of surveying. To impart the knowledge of surveying and latest technologies in surveying it is necessary to introduce this subject in the curriculum.

Outcomes: Able to perform various surveying techniques using lastest technologies in surveying

Unit-I:

Introduction and Basic Concepts

Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions

Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections, Indirect methods- optical methods- E.D.M. method.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination and dip

Unit-II

Levelling and Contouring

Leveling- Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

Computation of Areas and Volumes

Areas- Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

Volumes- Computation of areas for level section and two level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

Unit-III

Theodolite Surveying

Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing

Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

Unit-IV

Tacheometric Surveying

Principles of Tacheometry, stadia and tangential methods of Tacheometry.

Curves

Types of curves and their necessity, elements of simple curve, setting out of simple Curves, Introduction to compound curves.

Unit-V

Modern Surveying Methods

Total Station and Global Positioning System. : Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

TEXT BOOKS:

1. Chandra A M, "Plane Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
2. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
3. Duggal S K, "Surveying (Vol – 1 & 2), Tata Mc.Graw Hill Publishing Co. Ltd. New Delhi, 2004.
4. Hoffman.B, H.Lichtenegga and J.Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001.

REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004
3. Surveying (Vol – 1, 2 & 3), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi
4. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi
5. Surveying by BHAVIKATTI; Vikas publishing house ltd.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	3

FLUID MECHANICS

Pre Requisites: Engineering Mechanics

Objectives: This subject introduces the basic concepts of fluids, their behavioural properties, analyzing the fluid flows using primary equations. This subject further deals with various flow measuring devices and concepts of boundary layer flows.

Outcomes: Engineering Mechanics

UNIT I

INTRODUCTION : Dimensions and units – Physical properties of fluids specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motionpressure at a point, Pascal's law, Hydrostatic law - atmospheric, gauge and vacuum pressure- measurement of pressure. Pressure gauges, Manometers: differential and Micro Manometers. Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure. Derivations and problems.

UNTI – II

FLUID KINEMATICS : Description of fluid flow, Stream line, path line and streak lines and stream tube. Classification of flows : Steady, unsteady, uniform, nonuniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, flownet analysis.

UNIT – III

FLUID DYNAMICS and Measurement of Flow: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line for 3-D flow, (Navier – stokes equations (Explanationary) Momentum equation and its application – forces on pipe bend. Pitot tube, Venturi meter and orifice meter – classification of orifices, flow over rectangular, triangular and trapezoidal and Stepped notches - –Broad crested weirs

UNIT - IV

CLOSED CONDUIT FLOW: Reynold's experiment – Characteristics of Laminar & Turbulent flows. Laws of Fluid friction – Darcy's equation, ,variation of friction factor with Reynold's number – Moody's Chart, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line. Pipe network problems Flow between parallel plates, Flow through long tubes, flow through inclined tubes.

UNIT – V

BOUNDARY LAYER THEORY: Approximate Solutions of Navier Stoke's Equations – Boundary layer – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarmen momentum integral equation, laminar and turbulent Boundary layers (no derivations) BL in transition, separation of BL, control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

TEXT BOOKS:

1. Fluid Mechanics by Modi and Seth, Standard book house.
2. Introduction to Fluid Machines by S.K.Som & G.Biswas (Tata Mc.Grawhill publishers Pvt. Ltd.)
3. Introduction to Fluid Machines by Edward J. Shaughnessy, Jr, Ira M. Katz and James P. Schaffer , Oxford University Press, New Delhi

REFERENCES:

1. Fluid Mechanics by J.F.Douglas, J.M. Gaserek and J.A.Swaffirld (Longman)
2. Fluid Mechanics by Frank.M. White (Tata Mc.Grawhill Pvt. Ltd.)
3. Fluid Mehanics by A.K. Mohanty, Prentice Hall of India Pvt. Ltd., New Delhi
4. A text of Fluid mechanics and hydraulic machines by Dr. R.K. Bansal - Laxmi Publications (P) ltd., New Delhi

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II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
0	0	3	2

COMPUTER AIDED DRAFTING LAB-I

Pre Requisites: Engineering Mechanics

Objectives: The object of this lab is to teach the student basic drawing fundamentals in various civil engineering applications, specially in building drawing.

Outcomes: Student will be able to master the usage of autocad commands for drawing 20 & 30 building drawings and also the usage autocad for different civil engg applications.

1. Introduction to computer aided drafting
2. Software for CAD – Introduction to different softwares
3. Practice exercises on CAD software
4. Drawing of plans of buildings using software
   a) single storeyed buildings b) multi storyed buildings
5. Developing sections and elevations for
   a) single storeyed buildings b) multi storyed buildings
6. Detailing of building components like Doors, Windows, Roof Trusses etc. using CAD softwares
7. Exercises on development of working drawings of buildings

Text Books :

1. Computer Aided Design Laboratory by M. N. Sesha Praksh & Dr. G. S. Servesh – Laxmi Publications.
2. Engineering Graphics by P. J. Sha – S. Chand & Co.

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II Year B.Tech. Civil Engg. I-Sem

L	T	P	C
0	0	3	1

STRENGTH OF MATERIALS LAB

Pre Requisites: Strength of Materials – Theory

Objectives: The object of the course to make the student to understand the behaviour of materials under different types of loading for different types structures

Outcomes: Able to identify the various properties of engineering material.

1. Tension test
2. Bending test on (Steel / Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges
12. Continuous beam – deflection test.

List of Major Equipment:

1. UTM for conducting tension test on rods
2. Steel beam for flexure test
3. Wooden beam for flexure test
4. Torsion testing machine
5. Brinnell's / Rock well's hardness testing machine
6. Spring testing machine
7. Compression testing machine
8. Izod Impact machine
9. Shear testing machine
10. Beam setup for Maxwell's theorem verification.
11. Continuous beam setup
12. Electrical Resistance gauges.

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SURVEYING LAB –I

Pre Requisites: Surveying Theory

Objectives: To impart the practical knowledge in the field, it is essential to introduce in curriculum. Drawing of Plans and Maps and determining the area are pre requisites before taking up any Civil Engineering works.

Outcomes: Practically able to give drawing of plans & maps & determining the area before taking up any civil engineering works.

1. Surveying of an area by chain survey (closed traverse) & plotting.
2. Chaining across obstacles
3. Determine of distance between two inaccessible points with compass
4. Survey of a given area by prismatic compass (closed traverse) and plotting after adjustment.
5. Radiation method, intersection methods by plane table survey.
6. Two point and three point problems in plane table survey.
7. Levelling – Longitudinal and cross-section and plotting
8. Trigonometric leveling using theodolite
9. Height and distances using principles of tacheometric surveying
10. a) Measurement of Horizontal angle & vertical angle.
    b)Distance between inaccessible point by theodolite

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II Year B.Tech. Civil Engg. I-Sem

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HUMAN VALUES AND PROFESSIONAL ETHICS

Pre Requisites: NIL

Objectives: The object of subject is to develop personality development, professional responsibility in Engineering, have a knowledge about rights, global issues

Outcomes: Student will be perfect with human values up professional ethics which is essential in any kind of work in engineering field

Unit 1 Human Values: Morals, values, ethics – integrity – work ethics –service learning – civic virtue – respect for others- living peacefully - Caring –sharing –honesty – courage – valuing time – cooperation – commitment –empathy – self-confidence –spirituality – character- Mini-Cases

Unit II Professional Ethics: Profession- and professionalism - Two models of professionalism –Professional etiquette -Three types of Ethics or morality Responsibility in Engineering – Engineering standards –Engineering Ethics – Positive and Negative Faces. Professional Codes and Code of conduct (as given by ASME, ASCE, IEEE, IETE, Institute of Engineers as Guidelines for ethical conduct). Mini-cases.

Unit III Professional Responsibilities: Ethical standards Vs Professional Conduct – Zero Tolerance for Culpable Mistakes – Hazards and Risks- Risk benefit analysis– congeniality, collegiality and loyalty. Respect for authority – conflicts of interest – occupational crime — Mini-Cases.

Unit IV Professional Rights: professional rights and employee rights communicating risk and public policy – Whistle blowing - collective bargaining. Professionals /engineers as managers, advisors, experts, witnesses and consultants – moral leadership- Regulatory compliances, Monitoring and control- Mini-Cases

Unit V Ethics in global context: Global issues in MNCs- Problems of bribery, extortion, and grease payments – Problem of nepotism, excessive gifts – paternalism – different business practices – negotiating taxes. Mini-Cases.

Mini-projects

Project 1: The student of this course should invariably attend (or watch on internet/any TV channel/youtube/social media) two speeches of 30 minutes duration each dealing with spiritual discourse and submit a report on the contents of the lecture proceedings.

Project 2: Visit any organization (including shops/ hotels or shopping malls in your region) of your choice and observe how the professionals perform the given job with a focus on professional ethics and human values.

References

1. Aryasri, *Human Values and Professional Ethics*, Maruthi Publications.
2. S B George, *Human Values and Professional Ethics,* Vikas Publishing.
3. KR Govindan & Saenthil Kumar:Professional *Ethics and Human Values*, Anuradha Publications.
4. S K Chakraborthy & D.Chakraborthy: *Human Values and Ethics*, Himalaya.
5. M. Govindarajan, S. Natarajan, & V.S. Senthilkumar: *Engineering Ethics(Includes Human Values),* HI Learning Pvt. Ltd., New Delhi – 110001

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STRENGTH OF MATERIALS – II

Pre Requisites: Strength of Materials -I

Objectives: Study of the subject provides the understanding of principal stress, strains, springs, columns and structures.

Outcomes: Students will be able to know the principles for practical design of columns, curved beams, springs, thick & thin cylinders, circular shafts etc.

UNIT – I

TORSION OF CIRCULAR SHAFTS :

Theory of pure torsion – Derivation of Torsion equations : $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

SPRINGS

Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs.

UNIT – II

COLUMNS AND STRUTS :

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

BEAM COLUMNS : Laterally loaded struts – subjected to uniformly distributed and concentrated loads – Maximum B.M. and stress due to transverse and lateral loading.

UNIT - III

DIRECT AND BENDING STRESSES :

Stresses under the combined action of direct loading and bending moment, core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and bending moment about both axis.

BEAMS CURVED IN PLAN:

Introduction – circular beams loaded uniformly and supported on symmetrically placed Columns – Semi-circular beam simply-supported on three equally spaced supports.

UNIT – IV

THIN CYLINDERS :

Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Thin spherical shells.

THICK CYLINDERS :

Introduction - Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

UNIT – V

UNSYMETRICAL BENDING :

Introduction – Centroidal principal axes of section – Graphical method for locating principal axes – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis - Deflection of beams under unsymmetrical bending.

SHEAR CENTRE: Introduction - Shear centre for symmetrical and unsymmetrical (channel, I, T and L) sections

Text Books:

1) Strength of Materials by R.K.Bansal, Lakshmi Publications House Pvt. Ltd.
2) Strength of Materials by R.K Rajput, S.Chand & Company Ltd.

References:

1) Fundamentals of Solid Mechancis by M.L.Gambhir, PHI Learning Pvt. Ltd
2) Introduction to Strength of Materials by U.C.Jindal, Galgotia Publications Pvt. Ltd.
3) Mechanics of Materials by R.C.Hibbeler, Pearson Education
4) Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5) Strength of Materials by S.S.Rattan, Tata McGraw Hill Education Pvt. Ltd.
6) Strength of Materials by R.Subramanian, Oxford University Press.
7) Mechanics of Materials by Ferdinand P. Beer *et al.,* Tata McGraw Hill Education Pvt. Ltd.

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HYDRAULICS & HYDRAULIC MACHINERY

Pre Requisites: Fluid Mechanics

Objectives: The main objective of this course to deal with the concepts of flow through open channels and their applications and the principles of hydraulic machines and hydraulic models

Outcomes: Students will be able to know about the flow through open channels & also practical applications of hydraulic mechanics importants of hydraulic models.

UNIT – I

OPEN CHANNEL FLOW: Types of flows - Type of channels – Velocity distribution – Energy and momentum correction factors – Chezy's, Manning's; and Bazin formulae for uniform flow – Most Economical sections. Critical flow: Specific energy-critical depth – computation of critical depth – critical sub-critical and super critical flows. Non uniform flow-Dynamic equation for G.V.F., Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT - II

HYDRAULIC SIMILITUDE : Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations. Distorted and non-distorted models.

UNIT – III

BASICS OF TURBO MACHINERY : Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle, Applications to radial flow turbines.

UNIT - IV

HYDRAULIC TURBINES : Layout of a typical Hydropower installation – Heads and efficiencies-classification of turbines-pelton wheel-Francis turbine-Kaplan turbine-working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and function efficiency. Governing of turbines-surge tanks-unit and specific turbines-unit speed-unit quantity-unit power-specific speed performance characteristics-geometric similarity-cavitation .

UNIT – V

CENTRIFUGAL PUMP : installation details-classification-types work done- Manometric head-minimum starting speed-losses and efficiencies-specific speedmultistage pumps-pumps in parallel- performance of pumps-characteristic curves- NPSH-cavitation.

Classification of Hydropower plants – Definition of terms – load factor, utilization factor, capacity factor, estimation of hydropower potential.

TEXT BOOKS:

1. Open Channel flow by K,Subramanya . Tata Mc.Grawhill Publishers
2. A text of Fluid mechanics and hydraulic machines by Dr. R.K. Bansal - Laxmi Publications (P) ltd., New Delhi
3. Fluid Mechanics & Fluid Power Engineering by D.S. Kumar Kataria & Sons.

REFERENCES :

1. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.
2. Elements of Open channel flow by Ranga Raju, Tata Mc.Graw Hill, Publications.
3. Fluid mechanics and fluid machines by Rajput, S.Chand &Co.
4. Open Channel flow by V.T.Chow, Mc.Graw Hill book company.
5. Hydraulic Machines by Banga & Sharma Khanna Publishers.

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STRUCTURAL ANALYSIS – I

Pre Requisites: Strength of Materials –I

Objectives: To make the students to understand the principles of analysis of structures of static and moving loads by various methods.

Outcomes: Students will be able to know the principles for practical design of structures subjected to static & moving loads.

UNIT – I

ANALYSIS OF PERFECT FRAMES: Types of frames- Perfect, Imperfect and Redundant pin jointed frames. - Analysis of determinate pin jointed frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

UNIT – II

ENERGY THEOREMS: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Unit Load Method. Deflections of simple beams and pin- jointed plane trusses. Deflections of statically determinate bent frames.

THREE HINGED ARCHES – Introduction – Types of Arches – Comparision between Three hinged and Two hinged Arches. Linear Arch. Eddy's theorem. Analysis of Three hinged arches. Normal Thrust and radial shear in an arch. Geometrical properties of parabolic and circular arch. Three hinged circular arch at different levels. Absolute maximum bending moment diagram for a three hinged arch.

UNIT-III

PROPPED CANTILEVER and FIXED BEAMS: Determination of static and kinematic indeterminacies for beams- Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia, subjected to uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - Shear force and Bending moment diagrams for Propped Cantilever and Fixed Beams-Deflection of Propped cantilever and fixed beams; effect of sinking of support, effect of rotation of a support.

UNIT – IV

CONTINUOUS BEAMS: Introduction-Continuous beams. Clapeyron's theorem of three moments- Analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed-continuous beams with overhang. Effects of sinking of supports.

SLOPE DEFLECTION METHOD: Derivation of slope-deflection equation, application to continuous beams with and without settlement of supports. Determination of static and kinematic indeterminaciesfor frames. Analysis of Single Bay – Single storey Portal Frames by Slope Deflection Method Including Side Sway. Shear force and bending moment diagrams and Elastic curve.

UNIT – V

MOVING LOADS and INFLUENCE LINES: Introduction maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load U.D load longer than the span, U.D load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length. Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a section - Point loads, UDL longer than the span, UDL shorter than the span- Influence lines for forces in members of Pratt and Warren trusses. Equivalent uniformly distributed load. Focal length.

Text Books:

1) Structural Analysis Vol –I & II by V.N.Vazirani and M.M.Ratwani, Khanna Publishers.
2) Structural Analysis Vol I & II by G.S.Pandit and S.P.Gupta, Tata McGraw Hill Education Pvt. Ltd.
3) Basic Structural Analysis by K.U.Muthu *et al.,* I.K.International Publishing House Pvt.Ltd.

References:

1) Structural Analysis by R.C.Hibbeler, Pearson Education
2) Mechanics of Structures Vol – I and II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
3) Structural Analysis by Devdas Menon, Narosa Publishing House.
4) Basic Structural Analysis by C.S.Reddy., Tata McGraw Hill Education Pvt. Ltd.
5) Fundamentals of Structural Analysis by M.L.Gamhir, PHI Learning Pvt. Ltd
6) Structural Analysis -I by S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.

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ENGINEERING GEOLOGY

Pre Requisites: Building Materials

Objectives: The objectives was course is to give the basics knowledge of Geology that is required for constructing various Civil Engineering Structures in the syllabus include the basic Geology, Geological Hazardous and Environmental Geology which gives a complete picture on the Geological aspects that are to be considered for the planning and construction of major Civil Engineering projects

Outcomes: Student will acquire basic knowledge of geology.

UNIT - I

INTRODUCTION: Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology.

WEATHERING OF ROCKS : Its effect over the properties of rocks importance of weathering with REFERENCE to dams, reservoirs and tunnels weathering of common rock like “Granite”

UNIT - II

MINERALOGY : Definition of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties.Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldsper , Quartiz , Flint , Jasper, Olivine , Augite , Hornblende , Muscovite , Biotite , Asbestos, Chlorite , Kyanite , Garnet, Talc , Calcite. Study of other common economics minerals such as Pyrite, Hematite , Magnetite, Chrorite , Galena , Pyrolusite , Graphite, Magnesite, and Bauxite.

PETROLOGY : Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Dykes and sills, common structures and textures of igneous. Sedimentary and metamorphic rocks. Their distinguishing features, Megascopic and microscopic and microscopic study of Granite, Dolerite, Basalt, Pegmatite, Laerite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

UNIT - III

STRUCTURAL GEOLOGY : Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults uncomfornities, and joints - their important types and case studies. Their importance Insitu and drift soils, common types of soils, their origin and occurrence in India, Stabilisation of soils. Ground water, Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration.

UNIT - IV

EARTH QUAKES : Causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Land slides, their causes and effect; measures to be taken to prevent their occurrence. Importance of study of ground water, earth quakes and land slides.

IMPORTANCE OF GEOPHYSICAL STUDIES : Principles of geophysical study by Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and Geothermal method. Special importance of Electrical resistivity methods, and seismic refraction methods. Improvement of competence of sites by grouting etc. Fundamental aspects of Rock mechanics and Environmental Geology.

UNIT - V

GEOLOGY OF DAMS , RESERVOIRS AND TUNNELS: Types of dams and bearing of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factor's Contributing to the success of a reservoir. Geological factors influencing water Lightness and life of reservoirs - Purposes of tunneling, Effects of Tunneling on the ground Role of Geological Considerations (ie. Tithological, structural and ground water) in tunneling over break and lining in tunnels.

TEXT BOOKS:

1) Engineering Geology by N.Chennakesavulu, Mc-Millan, India Ltd. 2005
2) Engineering Geology for Civil Engineers – P.C. Varghese PHI
3) Engineering Geology by Parbin Singh, S.K.Kataria & Sons.
4) Principles of Engineering Geology by K.V.G.K. Gokhale – B.S publications

REFERENCES:

1. F.G. Bell, Fundamental of Engineering Geology Butterworths, Publications, New Delhi, 1992.
2. Krynine & Judd, Principles of Engineering Geology & Geotechnics, CBS Publishers & Distribution
3) Engineering Geology by Subinoy Gangopadhyay, Oxford university press.

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ENVIRONMENTAL ENGINEERING

Pre Requisites: Fluid Mechanic

Objectives: This subject provides the knowledge of water sources, water treatment, design of distribution system waste water treatment, and safe disposal methods. The topics of characteristics of waste water, sludge digestion are also included.

Outcomes: Student will able to provide fundamental for wate treatment, design of distribution system waste water

UNIT – I

Introduction : Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries .

UNIT II

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices- Miscellaneous treatment methods.

UNIT-III

Distribution systems requirement –method and layouts -Design procedures- Hardy Cross and equivalent pipe methods pipe – joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines – pump house - Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow

UNIT - IV

characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D.Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pumphouses – house drainge – components requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming – dilution.

UNIT – V

Waste water treatment plant – Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – standard and high rate – Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

TEXT BOOKS :

1. Water supply and sanitary Engineering by G.S. Birdi, Dhanpat Rai & Sons Publishers.
2. Water Supply & Environmental Engineering by A.K. Chatterjee.
3. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.

REFERENCE BOOK :

1. Water and Waste Water Technology by Steel
2. Water and Waste Water Engineering by Fair Geyer and Okun
3. Text book of Environemental Engineering by P. Venugopal Rao (PHI)
4. Waste water Engineering by Metcalf and Eddy.
5. Unit operations in Environmental Engineering by R. Elangovan and M.K. Sasutharam (Newage)

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II Year B.Tech. Civil Engg. II-Sem

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ENGINEERING GEOLOGY LAB

Pre Requisites: Engineering Geology Theory

Objectives: The object of this lab is that to provide practical knowledge about physical properties of minerals, rocks, drawing of geological maps, showing faults, uniformities etc.

Outcomes: Identify the various rocks, minerals depending on geological classifications

1. Study of physical properties and identification of minerals referred under theory.
2. Megascopic description and identification of rocks referred under theory.
3. Microscopic study of rocks.
4. Interpretation and drawing of sections for geological maps showing tilted beds, faults, uniformities etc.
5. Simple Structural Geology problems.
6. Electrical resistivity meter.

LAB EXAMINATION PATTERN:

1. Description and identification of SIX minerals
2. Description and identification of Six (including igneous, sedimentary and metamorphic rocks)
3. Inter pretation of a Geological map along with a geological section.
4. Simple strike and Dip problems.
5. Microscopic identification of rocks.

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ENVIRONMENTAL ENGINEERING LAB

Pre Requisites: Chemistry Laboratory

Objectives: The laboratory provides knowledge of estimating various parameters like PH, Chlorides, Sulphates, Nitrates in water. For effective water treatment, the determination of optimum dosage of coagulant and chloride demand are also included. The estimation status of industrial effluents will also be taught in the laboratory by estimating BOD and COD of effluent.

Outcomes: Students can provide various properties of water

LIST OF EXPERIMENTS

1. Determination of pH and Turbidity
2. Determination of Conductivity and Total dissolved solids (Organic and Inorganic)
3. Determination of Alkalinity/Acidity.
4. Determination of Chlorides.
5. Determination of iron.
6. Determination of Dissolved Oxygen.
7. Determination of Nitrates.
8. Determination of Optimum dose of coagulant
9. Determination of Chlorine demand
10. Determination of total Phosphorous.
11. Determination of B.O.D
12. Determination of C.O.D
13. Presumptive coliform test.

NOTE: At least 8 of the above experiments are to be conducted.

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FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Pre Requisites: FM & HHM Theory

Objectives: To give the student an exposure to various hydraulic devices and hydraulic machines.

Outcomes: Fluid Mechanics & Hydraulics Machinery

1. Calibration of Venturimeter & Orifice meter
2. Determination of Coefficient of discharge for a small orifice / mouthpiece by constant head method.
3. Calibration of contracted Rectangular Notch and / Triangular Notch
4. Determination of friction factor of a pipe.
5. Determination of Coefficient for minor losses.
6. Verification of Bernoulli's equation.
7. Impact of jet on vanes
8. Study of Hydraulic jump.
9. Performance test on Pelton wheel turbine
10. Performance test on Francis turbine.
11. Performance characteristics of a single stage/ multi-stage centrifugal pump.
12. Performance characteristics of a reciprocating pump.

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OPEN ELECTIVE – I

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Pre-Requisites: Mathematics

Course Objectives: To explain the basic principles of managerial economics, accounting and current business environment underlying business decision making.

Course Outcomes: Student will able to solve various business problem up make various business decision

Unit I Introduction & Demand Analysis: Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. *Elasticity of Demand*: Definition, Types, Measurement and Significance of Elasticity of Demand. *Demand Forecasting,* Factors governing demand forecasting, methods of demand forecasting.

Unit II Production & Cost Analysis: *Production Function* – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. *Cost Analysis***:** Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit III Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. *Pricing*: Objectives and Policies of Pricing. Methods of Pricing. *Business:* Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, *New Economic Environment*: Changing Business Environment in Post-liberalization scenario.

Unit IV Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital Trading Forecast Capital Budget, Cost Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

Unit V Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions Introduction IFRS Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis***:** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
2. Vijay Kumar & Appa Rao Managerial Ecoconomics & Financial Analysis, Cengage 2011.
3. J. V. Prabhakar Rao & P.V. Rao Managerial Ecoconomics & Financial Analysis, Maruthi Publishers, 2011.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2009
4. Domnick Salvatore: Managerial Economics In a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting—A Managerial Perspective, PHI, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Kasi Reddy Sraswathi, MEFA PHI Learning, 2012.
10. Shailaja & Usha : MEFA, University Press, 2012.

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DESIGN OF REINFORCED CONCRETE STRUCTURES

Pre-Requisites: Structural Analysis I & II

Course Objectives: Structural elements are subjected to different loading to with stand the structures, for external loading we need to design the structures for its safety and serviceability.

Course Outcomes: Design various structures

UNIT –I

Concepts of RC. Design – Working Stress Method - Limit State method – Material Stress-Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456 – 2000.

Beams: Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections

UNIT –II

Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing ; Design of canopy.

UNIT – III

Short and Long columns – under axial loads, uniaxial bending and biaxial bending – I S Code provisions.

UNIT – IV

Footings: Different types of footings – Design of isolated, square, rectangular, circular footings and combined footings.

UNIT - V

Design of Two-way slabs, one way slab, and continuous slab Using I S Coefficients
Limit state design for serviceability for deflection, cracking and codal provision.
Design of dog-legged staircase.

TEXT BOOKS:

1. Limit state designed of reinforced concrete – P.C.Varghese, Prentice Hall of India, New Delhi.
2. Reinforced concrete design by S.Unnikrishna Pillai & Devdas Menon, Tata Mc.Graw Hill, New Delhi.
3. Reinforced concrete design by N. Krishna Raju and R.N. Pranesh, New age International Publishers, New Delhi

REFERENCES :

1. Fundamentals of Reinforced concrete design by M.L. Gambhir, Printice Hall of India Private Ltd., New Delhi.
2. Design of concrete structures by J.N.Bandhyopadhyay PHI Learning Private Limited.
3. Design of Reinforced Concrete Structures by I.C.Syal and A.K.Goel, S.Chand & company.
4. Fundamentals of reinforced concrete by N.C. Sinha and S.K Roy, S. Chand publishers
5. Design of Reinforced Concrete Foundations – P.C. Varghese Prentice Hall of India, New Delhi.
6.. Reinforced concrete structures, Vol.1, by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
7. Design of concrete structures – Arthus H.Nilson, David Darwin, and Chorles W. Dolar, Tata Mc.Graw-Hill, 3rd Edition, 2005.

NOTE :

Alternate weeks two periods of drawing class should be conducted. The end examination paper should consist of Part – A and Part – B. Part – A should consist of two questions in design and drawing out of which one question to be answered. Part –B should consist of five questions in design out of which three to be answered. Weightage for Part – A is 40 % and Part – B is 60 %.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

III Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

SOIL MECHANICS

Pre-Requisites: Engineering Geology

Course Objectives: To enable the student to study the properties of soil and to determine the behaviour soil under various conditions and loads.

Course Outcomes: Can understand the mechanism and Behaviour of Soil for Different loads and Soil Condition able to determine properties of soil

UNIT – I

INTRODUCTION: Soil formation and structure – moisture content – Mass- volume relationship – Relative density.

INDEX PROPERTIES OF SOILS: Grain size analysis – Sieve– consistency limits and indices – I.S. Classification of soils.

UNIT –II

PERMEABILITY: Soil water – capillary rise – flow of water through soils – Darcy's law-permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered soils – In-situ permeability tests (Pumping in & Pumping out test).

EFFECTIVE STRESS & SEEPAGE THROUGH SOILS: Total, neutral and effective stress – principle of effective stress - quick sand condition – Seepage through soils – Flownets: Characteristics and Uses.

UNIT –III

STRESS DISTRIBUTION IN SOILS: Boussinesq's and Westergaard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal plane, and Newmark's influence chart for irregular areas.

COMPACTION: Mechanism of compaction – factors affecting compaction – effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

UNIT – IV

CONSOLIDATION: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil - preconsolidation pressure and its determination - Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods - computation of total settlement and time rate of settlement.

UNIT - V

SHEAR STRENGTH OF SOILS: Importance of shear strength – Mohr's– Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelops – Shear strength of sands - dilatancy – critical void ratio.

Text books:

1 Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt . Ltd, New Delhi
2. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
3. Foundation Engineering by P.C.Varghese, PHI

References:

1. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
2. Principals of Geotechnical Engineering by Braja M.Das, Cengage Learning Publishers.
3. Geotechnical Engineering by C. Venkataramiah, New age International Pvt . Ltd, (2002).
4. Geotechnical Engineering Principles and Practices by Cuduto, PHI Intrernational.
5. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata Mc.Grawhill Publishers New Delhi.
6. Soil Mechanics and Foundation by by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

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WATER RESOURCES ENGINEERING-I

Pre-Requisites: Fluid Mechanics & HHM

Course Objectives: To study the concepts of

i. Engineering Hydrology and its applications like Runoff estimation, estimation of design discharge and flood routing.
ii. Irrigation Engineering – Water utilization for crop growth and their designs.

Course Outcomes: Estimate runoff, design discharge up flood waiting, Irrigation enginering

UNIT I

Introduction to engineering hydrology and its applications, Hydrologic cycle, types and forms of precipitation, rainfall measurement, types of rain gauges, computation of average rainfall over a basin, processing of rainfall data - Adjustment of record -Rainfall Double Mass Curve. Runoff- Factors affecting Runoff – Runoff over a Catchment- Empirical and Rational Formulae.

Abstraction from rainfall-evaporation, factors affecting evaporation, measurement of evaporation- Evapotranspiration- Penman and Blaney & Criddle Methods -Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices..

UNIT-II

Distribution of Runoff – Hydrograph Analysis Flood Hydrograph – Effective Rainfall – Base Flow- Base Flow Separation - Direct Runoff Hydrograph Unit pulse and Unit step function - Unit Hydrograph, definition, limitations and applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa - S-hydrograph, Synthetic Unit Hydrograph.

UNIT-III

Ground water Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, Darcy's law, radial flow to wells in confined and unconfined aquifers. Types of wells,- Well Construction – Well Development.

UNIT-IV

Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Indian agricultural soils, methods of improving soil fertility –Crop Rotation, preparation of land for Irrigation, standards of quality for Irrigation water.

Soil-water-plant relationship, vertical distribution of soil moisture, soil moisture constants, soil moisture tension, consumptive use, Duty and delta, factors affecting duty- Design discharge for a water course. Depth and frequency of Irrigation, irrigation efficiencies-Water Logging.

UNIT-V

Classification of canals, Design of Irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting, IS standards for a canal design canal lining.
Design Discharge over a catchment, Computation of design discharge-rational formulae etc.

Text books:

1. Engineering Hydrology by Jayaram Reddy, Laxmi publications pvt. Ltd., New Delhi
2. Irrigation and water power engineering by Punmia & Lal, Laxmi publications pvt. Ltd., New Delhi

References:

1. Elementary hydrology by V.P.Singh, PHI publications.
2. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.
3. Irrigation Water Management by D.K. Majundar, Printice Hall of India.
4. Irrigation and Hydraulic structures by S.K.Grag - Khanna **publishers**
5. Applied hydrology by Ven Te Chow, David R. Maidment larry W. Mays Tata MC. Graw Hill.

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ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

Pre-Requisites: English

Course Objectives: The purpose of this course is to develop the students competence in communication at an advanced level. Assuming that the students are fairly proficient in the basic communication skills of listening, speaking, reading and writing in English, this course aims to train them in communicating efficiently in the workplace and professional contexts.

Course Outcomes: Communicate efficiently in the work place up professioal context

1. Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Learning Outcomes

- Accomplishment of sound vocabulary and its proper use contextually.
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. Prescribed Lab Manual: A book titled ***A Course Book of Advanced Communication Skills (ACS) Lab*** published by Universities Press, Hyderabad.

6. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass**, 8th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE** (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

7. Books Recommended:

1. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.
3. **Advanced Communication Skills Laboratory Manual** by Sudha Rani, D, Pearson Education 2011.
4. **Technical Communication** by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. **Business and Professional Communication:** Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
6. **The Basics of Communication: A Relational Perspective**. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
7. **English Vocabulary in Use** series, Cambridge University Press 2008.
8. **Management Shapers Series** by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
9. **Handbook for Technical Communication** by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
10. **Communication Skills** by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
11. **Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
12. **Job Hunting** by Colm Downes, Cambridge University Press 2008.
13. **Master Public Speaking** by Anne Nicholls, JAICO Publishing House, 2006.
14. **English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.**
15. Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron's/DELTA/Cambridge University Press.
16. **International English for Call Centres** by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

***Advanced Communication Skills Lab Practicals**:*

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the

non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

Mini Project: As a part of Internal Evaluation

1. **Seminar/ Professional Presentation**
2. **A Report on the same has to be prepared and presented.**

* ***Teachers may use their discretion to choose topics relevant and suitable to the needs of students.***
* ***Not more than two students to work on each mini project.***
* ***Students may be assessed by their performance both in oral presentation and written report.***

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III Year B.Tech. Civil Engg. I-Sem	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

SURVEYING LAB –II

Pre-Requisites: Surveying Theory

Course Objectives: To impart the practical knowledge in the field to set out any Civil Engineering work

Course Outcomes: Perform surveying on any civi8l engineering work

1. Determine of area using total station
2. Traversing using total station
3. Contouring using total station
4. Determination of remote height using total station
5. Stake out using total station
6. Distance, gradient, differential height between two inaccessible points using total station.
7. Curve settling using total station
8. Resection using total station
9. Setting out works for buildings and pipe lines
10. Finding position of stations using G.P.S

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L	T	P	C
0	0	3	2

GEO TECHNICAL ENGINEERING LAB

Pre-Requisites: Soil Mechanics (Co-requisite)

Course Objectives: To obtain the properties of soils by conducting experiments, it is necessary for students to understand the behavior of soil under various loads and conditions.

Course Outcomes: Able to determine index and engg properties of soils

LIST OF EXPERIMENTS

1. Atterberg Limits (Liquid Limit, Plastic Limit)
2. a) Field density by core cutter method and
   b) Determination of Specific gravity of soil.
3. Field density by sand replacement method
4. Grain size distribution by sieve analysis
5. Permeability of soil by constant and variable head test methods
6. Standard Proctor's Compaction Test
7. California Bearing Ratio Test (CBR Test)
8. Determination of Coefficient of consolidation (square root time fitting method)
9. Unconfined compression test
10. Direct shear test
11. Vane shear test
12. Differential free swell index (DFSI) test

Note: *Any* ***Ten*** *experiments may be completed.*

REFERENCE BOOK

1. Measurement of Engineering Properties of Soils by. E. Saibaba Reddy & K. Rama Sastri, New Age International.

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	3	**0**	**0**	**3**

OPEN ELECTIVE – II

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III Year B.Tech. Civil Engg. II-Sem	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

DEPARTMENT ELECTIVE – I

JNTUH COLLEGE OF ENGINEERING HYDERABAD

III Year B.Tech. Civil Engg. II-Sem	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

DEPARTMENT ELECTIVE – II

JNTUH COLLEGE OF ENGINEERING HYDERABAD

III Year B.Tech. Civil Engg. II-Sem	**L**	**T**	**P**	**C**
	3	**1**	**1**	**4**

DESIGN OF STEEL STRUCTURES

Pre-Requisites: Structural Analysis I & II

Course Objectives: To make the student conversant with the design principles of steel structural elements as per IS Codal provisions

Course Outcomes: Design any type of steel structure

UNIT – I

Materials – types of structural steel – mechanical properties of steel – Concepts of plasticity – yield strength. Loads – and combinations local buckling behavior of steel. Concept of limit State Design – Limit States – Design Strengths- deflection limits – serviceability – stability check. Bolted connections – Riveted connections – IS – 800 – 2007 - specifications – Design strength – efficiency of joint – prying action. Welded connections – Types of welded joints – specifications - design requirements.

UNIT – II

Design of tension members – Design strength – Design procedure splice - lug angle.
Design of compress in members – Buckling class – slenderness ratio / strength design – laced – battened columns – splice – column base – slab base.

UNIT – III

Design of Beams – Plastic moment – Bending and shear strength / buckling – Builtup sections – laterally / supported beams - Design of eccentric connections – Framed – stiffened / seat connection.

UNIT – IV

Design of plate girders – elements – economical depth – design of main section – connections between web and flange – design of stiffness bearing – intermediate stiffeners – Design of Websplica & Flange splica.

UNIT – V

Design of roof trusses – Types of roof trusses, loads on trusses – purlin design – truss design, Design of joints and end bearings.

Text books :

1. Design of steel structures – N. Subramanian, Oxford University Press – 2009.
2. Limit State Design of steel structures, S.K. Duggal, Tata McGraw-Hill, 2010

Reference books :

1. Design of Steel structures by K.S. Sai Ram, Person Education.
2. Design of Steel Structures Edwin H. Gaylord, Jr. Charles N. Gaylord and James Stallmeyer Tata McGraw-Hill Education pvt. Ltd.
3. Design of Steel Structures Vol. 1 & 2 – Ramchandra, Standard Publications.
4. Design of steel structures, Structures, S.S. Bhavikatti, IK int Publication House, New Delhi, 2010.
5. Structural Design and Drawing by N.Krishna Raju, Universities Press.

NOTE :

Alternate weeks two periods of drawing class should be conducted.The end examination paper should consist of Part – A and Part – B. Part – A should consist of two questions in design and drawing out of which one question to be answered. Part –Bshould consist of five questions in design out of which three to be answered. Weightage for Part – Ais 40 % and Part – B is 60 %.

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III Year B.Tech. Civil Engg. II-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

TRANSPORTATION ENGINEERING

Pre-Requisites: Surveying

Course Objectives: It deals with different components of Transportation Engineering like highway, Railway & Airport Engineering Emphasis is a Geometric Design of different elements in Transportation Engineering.

Course Outcomes: Student is knowledgeable of basic concepts of transportation engineering like highway, railway & airport engineering

UNIT I
HIGHWAY DEVELOPMENT AND PLANNING:
Highway Development in India – Necessity for Highway Planning- Different Road Development Plans; Classification of Roads - Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports – Highway Project.

UNIT – II
HIGHWAY GEOMETIC DESIGN: Importance of Geometric Design - Design controls and Criteria - Highway Cross Section Elements - Sight Distance Elements- Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance - Design of Horizontal Alignment - Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical alignment-Gradients- Vertical curves.

UNIT – III
TRAFFIC ENGINEERING & REGULATIONS :
Basic Parameters of Traffic-Volume, Speed and Density - Traffic Volume Studies - Data Collection and Presentation - Speed studies - Data Collection and Presentation - Origin & Destination studies, Parking Studies – Onstreet & Off street Parking - Road Accidents - Causes and Preventive Measures - Accident Data Recording – Condition Diagram and Collision Diagrams - Traffic Signs – Types and Specifications – Road Markings - Need for Road Markings-Types of Road Markings - Design of Traffic Signals – Webster Method.

UNIT – IV
INTERSECTION DESIGN :
Types of Intersections – Conflicts at Intersections – Requirements of At-Grade Intersections - Types of At-Grade Intersections: Channelized and Unchannelized Intersections – Traffic Islands - Types of Grade Separated Intersections - Rotary Intersection – Concept of Rotary – Design Factors of Rotary – Advantages and Limitations of Rotary Intersections.

UNIT - V

PAVEMENT DESIGN

Design of Pavements : Design of Flexible pavement by CBR method as per IRC 37-2012 and theory of empirical mechanistic method. Stresses in rigid pavement by westergards and IRC methods. Design of overlay by Benkelman beam method.

Text books:

1. Highway Engineering – S.K.Khanna & C.E.G.Justo, Nemchand & Bros., 7th edition (2000).
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna Publications – 6th Edition – 1997.

References:

1. Principles of Traffic and Highway Engineering – Garber & Hoel, Cengage Learning.
2. Principles and Practices of Highway Engineering – Dr.L.R.Kadiyali and Dr.N.BLal - Khanna Publications.
3. Highway Engineering – S.P.Bindra , Dhanpat Rai & Sons. – 4th Edition (1981)
4. IRC 37-2012 : Tentative guidelines for design of flexible pavement
5. IRC 58-2011: Guidelines for design of plain jointed rigid pavements.
6. IRC 81-1997 : Guidelines for design of overlay using Benkalman Beam Deflection Technique

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III Year B.Tech. Civil Engg. II-Sem

L	T	P	C
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TRANSPORTATION ENGINEERING LAB

Pre-Requisites: Transportation Engineering Theory

Course Objectives: To gain the practical knowledge of properties of Highway materials and surveys

Course Outcomes: Practically student can provide or identify properties of highway materials

I. ROAD AGGREGATES:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Abrasion Test
5. Flakiness and elongation Indices of coarse Aggregates.

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Marshal stability Test

III. TRAFFIC STUDIES

1. Traffic volume counts-Mid Blocks
2. Traffic volume counts-Junctions
3. Spot speed studies.
4. Parking Studies

TEXT BOOK:

1. Laboratory Manual in Highway Engineering by Ajay K.Duggal and Vijay P. Puri - Newage Publishers.
2. Highway Material Testing by Khanna S.K., Justo C.E.G, NemChand & Bros.
3. Principles and practice of Highway Engineering, L.R Kadiyali & N.B.Lal, Khanna, 2007.
4. Traffic Engineering and Transportation planning, L.R Kadiyali, Khanna publications, 2007.

OBJECTIVE: *To gain the practical knowledge of properties of Highway materials and surveys.*

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III Year B.Tech. Civil Engg. II-Sem

L	T	P	C
0	0	3	1

COMPUTER AIDED DRAFTING LAB - II

Pre-Requisites: CAD Lab – I & Excel, C - Programming

Course Objectives: To make student understand detailing of all kinds of structures might be of reinforced concrete , plain concrete , steel structures.

Course Outcomes: Student can draft various structures

1. Detailing of reinforcement in Cantilever, Simply supported and Contineous Beams (Both Singly & Doubly Reinforced Beams)
2. Detailing of reinforcement in canopy & columns (both uniaxial & biaxial)
3. Detailing of reinforcement in RC isolated footings square, rectangular, circular and combined footings.
4. Detailing of reinforcement in RC one-way, two-way slabs and dog-legged staircases.
5. Drawing of Steel bolted and welded connections.
6. Drawing of steel compression and tension members.
7. Drafting of steel beams-built-up sections.
8. Drafting of steel plate girder
9. Drafting of steel roof truss.

Note : Drafting of all the exercises is to be carried out using commercially available drafting softwares.

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L	T	P	C
0	0	3	2

CONCRETE TECHNOLOGY LAB

Pre-Requisites: Concrete Technology Theory

Course Objectives: To gain the practical knowledge of properties of concrete materials, behaviour of concrete and properties of fresh and hardened concrete

Course Outcomes: Provide properties of concrete material, behavior of concrete & properties of fresh & hardened concrete

I. Test on Cement

1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity of cement
4. Soundness of cement.
5. Compressive strength of cement.
6. Workability test on concrete by compaction factor, slump and Vee-bee.

II. Test on Aggregate

1. Sieve Analysis and gradation chairs
2. Bulking of sand.
3. Bulk and compact densities of fine and coarse aggregates

III. Test on Fresh Concrete

1. Slump test
2. CF (compact factor stress)
3. Vee-bee Test
4. Flow Table Test

Self Compacting Concrete

1. Slump cone
2. V funnel
3. L Box
4. U – box

IV. Test on hardened concrete

1. compression test on cubes & Cylinders
2. flexure test
3. Splitting Tesile Test
4. Modulus of Elasticity

V. Non Destructive test of concrete

1. Rebound hammer
2. Ultrasound pulse Velocity (UPV)
3. Rebar data scanner

TEXT BOOK:

1. Concrete Technology by M.S. Shetty – S.Chand & Co.
2. Concrete Manual by M.L. Gambhir, Dhanpat Rai & Sons

OBJECTIVE: To gain the practical knowledge of properties of concrete materials, behaviour of concrete and properties of fresh and hardened concrete.

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IV Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

FINITE ELEMENT METHODS

Pre Requisites: SA – I & SA – II
Course Objectives: The subject provides finite element methods and analysis
Course Outcomes: Anslysis Finite Element in engineering

UNIT – I
Introduction to Finite Element Method – Basic Equations in Elasticity Stress – Strain equation – concept of plane stress – plane strain advantages and disadvantages of FEM. Element shapes – nodes – nodal degree of freedom Displacement function – Natural Coordinates – strain displacement relations.

UNIT – II
Lagrangian – Serendipity elements – Hermite polynomials – regular, Irregular 2 D & 3D – Element –shape functions upto quadratic formulation.
Finite Element Analysis (FEA) of – one dimensional problems – Bar element – Shape functions stiffness matrix – stress – strain relation

UNIT – III
FEA Beam elements – stiffness matrix - shape function– Analysis of continuous beams.

UNIT – IV
FEA Two dimessional problem – CST – LST element – shape function – stress – strain.
Isoparametric formulation – Concepts of, isoparametric elements for 2D analysis - formulation of CST element.

UNIT-V
Solution Techniques: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

TEXT BOOK:
1. A first course in Finite Element Method by Daryl L. Logan, 5th Edition, Cengage Learning India Pvt. Ltd.
2. Introduction to finite Elements in Engineering by Tirupathi R. Chandrupatla, and Ashok D. Belegundu, Prentice Hall of India

REFERENCES:
1. Finite Element Aanalysis by P.Seshu, PHI Learning Private Limited
2. Concepts and applications of Finite Element Analysis by Robert D. Cook *et al.*, Wiley India Pvt. Ltd.
3. Applied Finite Element Analysis by G.Ramamurty, I.K.International Publishing House Pvt. Ltd.

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IV Year B.Tech. Civil Engg. I-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

UG - DEPARTMENTAL ELECTIVE- III

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

PG CORE - I

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L	T	P	C
4	1	0	4

Professional Elective - I

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

Professional Elective - II

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

Professional Elective - III

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. II-Sem

L	T	P	C
0	0	3	2

GEOGRAPHICAL INFORMATION SYSTEMS LAB

Prerequisites : Surveying
Course Objectives: Development of GIS interface to field problems through geofencing.
Course Outcomes: Exposed to spatial technologies, mapping the field problems and solution convergence through GIS.

UNIT 1 : Development of georeferencing of map either from cadastral or Autocad based map.
UNIT 2 : Identification of best locations of ground control points and mosaicing the different sources of maps of information like topo sheets & satellite data and other drawings.
UNIT 3 : Digitization and GIS coordination.
UNIT 4 : GIS interface and features in Arc info/ map info.
UNIT 5 : Case example on mapping like water distinguish, Road alignment road network etc.,

Text Books :

1. Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2002.
2. Burrough, P.A., Principles of Geographical Information Systems, Oxford Publication, 1998.
3. Clarke, K., Getting Started with Geographic Information Systems, Prentice Hall, New Jersy, 2001.
4. DeMers, M.N., Fundamentals of Geographic Information Systems, John Wiley & Sons, New York, 2000.
5. Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. I-Sem

L	T	P	C
0	0	4	2

CAAD LABORATORY

Objectives:
To impart knowledge on the use of various softwares

Outcomes:
The learner will be able to understand and design the structures using the software.

Prerequisites : Advanced Structural Analysis

1. Program for design of slabs. Using Excel
2. Program for design of beams. Using Excel
3. Program for design of column using Excel
4. Analysis of truss using STAAD Pro
5. Analysis of Multistoreyed space frame, using STAAD Pro, ETABS
6. Analysis of Bridge deck slab
7. Analysis of Plane frames using STAAD. Pro.
8. Program for Design of a combined footing using ETABS Excel
9. Program for Design of column using Excel.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. II-Sem

L	T	P	C
4	0	0	4

MANAGEMENT SCIENCE

Pre-Requisites: Managerial Economics & Financial Analysis

Course Objectives: To obtain knowledge about mananging of open business by analysing it theoritically

Course Outcomes: Able to management & make planning of any engineering project

Unit I Introduction to Management & Organisation: Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management - Taylor's Scientific Management Theory – Fayol's Principles of Management – Maslow's theory of Hierarchy of Human Needs – Douglas McGregor's Theory X and Theory Y – Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management. Designing Organisational Structures: Basic concepts related to Organisation - Departmentation and Decentralisation, Types and Evaluation of mechanistic and organic structures of organisation and suitability.

Unit II Operations & Marketing Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement – Business Process Reengineering Statistical Quality Control: control charts for Variables and Attributes, (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records – JIT System, Supply Chain Management Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

Unit III Human Resources Management (HRM): Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating – Capability Maturity Model (CMM) Levels – Performance Management System.

Unit IV Project Management *(PERT/CPM)*: Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

Unit V *Strategic Management and Contemporary Strategic Issues*: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced Score Card as Contemporary Business Strategies.

TEXT BOOKS:

1. Aryasri: *Management Science*, McGraw Hill, 2012.
2. Vijay Kumar and Appa Rao *Management Science*, Cengage, 2012.

REFERENCES :

1. Kotler Philip & Keller Kevin Lane: Marketing Management, Pearson, 2012.
2. Koontz & Weihrich: *Essentials of Management*, McGraw Hill, 2012.
3. Thomas N.Duening & John M.Ivancevich *Management—Principles and Guidelines,* Biztantra, 2012.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2012.
5. Samuel C.Certo: *Modern Management*, 2012.
6. Schermerhorn, Capling, Poole & Wiesner: *Management*, Wiley, 2012.
7. Parnell: *Strategic Management*, Cengage,2012.
8. Lawrence R Jauch, R.Gupta &William F.Glueck: *Business Policy and Strategic Management*, Frank Bros.2012.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. II-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

PG CORE - II

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. II-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(PG Elective – IV)

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. II-Sem

L	T	P	C
0	0	4	2

ADVANCED CONCRETE LABORATORY

Objectives: To impart knowledge on the test on cement and aggregates.

Outcomes:
The learner will be able to understand the properties of the materials and the behavior of the concrete.

Prerequisites : Concrete Technology Lab

1. Gradation Charts of Aggregates.
2. Bulking of fine Aggregate.
3. Aggregate Crushing and Impact value
4. Workability Tests on Fresh Self Compacting Concrete
6. Air Entrainment Test on Fresh Concrete
7. Rapidly Chloride Permeability Test.
8. Non Destructive Testing of Concrete.
9. Accelerated Curing of Concrete (Demo).
10. Behavior of Under Reinforced, over Reinforced and Shear Behavior of Beams.
11. Influence of W/C Ratio on Strength and Aggregate / Cement Ratio on Strength & Workability.
12. Influence of Different Chemical Admixtures on Concrete
13. Marsh Cone Test.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

V Year B.Tech. Civil Engg. I-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

PG Core – III

JNTUH COLLEGE OF ENGINEERING HYDERABAD

V Year B.Tech. Civil Engg. I-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(PG Elective – V)

JNTUH COLLEGE OF ENGINEERING HYDERABAD

V Year B.Tech. Civil Engg. I-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

PG Elective – VI

JNTUH COLLEGE OF ENGINEERING HYDERABAD

V Year B.Tech. Civil Engg. I-Sem	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(PG Elective – VII)

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

PG CORE - I
THEORY OF ELASTICITY

Objectives:
To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.

Course outcomes:
The learner will be able to solve problems of elasticity and plasticity and be able to apply numerical methods to solve continuum problems.

Prerequisites: Strength of Materials I & II

UNIT-I
Introduction: Elasticity - notation for forces and stress - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - differential equations of equilibrium - boundary conditions – Strain Displacement Relations - compatibility equations - stress function

UNIT II
Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venants principle - determination of displacements - bending of simple beams – Simple Supported and Cantilever Beam.

UNIT III
Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions Edge Dislocation - general solution of two-dimensional problem in polar coordinates - application to Plates with Circular Holes – Rotating Disk. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section.

UNIT IV
Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid - director surface - determination of principal stresses Stress Invariants - max shear stresses Stress Tensor – Strain Tensor- Homogeneous deformation - principal axes of strain-rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem Strain Energy.

UNIT V
Torsion of Circular Shafts - Torsion of Straight Prismatic Bars – Saint Venants Method - torsion of prismatic bars - bars with elliptical cross sections - membrane analogy - torsion of a bar of narrow rectangular bars - solution of torsional problems by energy method - torsion of shafts, tubes , bars etc.Torsion of Rolled Profile Sections.

References

1. Theory of Elasticity by Timeshenko, McGrawhill Publications.
2. Theory of Plasticity by J.Chakarbarthy, McGrawhill Publications.
3. Theory of Elasticity by Y.C.Fung.
4. Theory of Elasticity by Gurucharan Singh.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Civil Engg. II-Sem

L	T	P	C
4	1	0	4

PG CORE - II
STRUCTURAL DYNAMICS

Objectives:
To impart knowledge on the fundamental of structural dynamics and their applications.

Outcomes: The learner will be able to understand the equation of motion, dynamics response of single and multi degree-of freedom systems.

Prerequisites : Structural Analysis I & II

UNIT I:
Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle.

UNIT II
Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.
Single Degree of Freedom Systems : Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III
Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV
Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.
Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V
Introduction to Earthquake Analysis: Introduction - Excitation by rigid base translation - Lumped mass approach - SDOF and MDOF systems – Theory of Response Spectrum Method - analysis for obtaining response of multi storeyed buildings.

References:

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New york
2. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
4. I.S: 1893 (Part 1) - 2002, "Code of practice for Earthquake resistant design of Structures"

JNTUH COLLEGE OF ENGINEERING HYDERABAD

V Year B.Tech. Civil Engg. I-Sem

L	T	P	C
4	1	0	4

ANALYSIS OF PLATES & SHELLS
(PG Core – III)

Objectives:
To impart knowledge on the behavior and design of shells and Folded plates.

Outcomes:
The learner will be able to analyse and design the shells and folded plates.

Prerequisites : Theory of Elasticity, Structural Analysis

UNIT I
Small Deflection Theory of Thin Rectangular Plates : Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT II
Plates on Elastic Foundations : Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions - Large plate loaded at equidistant points by concentrated forces.

UNIT III
Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate

UNIT IV
Shells – functional behaviour – examples – structural behaviour of shells classification of shells – Definitions – various methods of analysis of shells – merits and demerits of each method – 2D. Membrane equation.
Equations of equilibrium: Derivation of stress resultants – cylindrical shells – Flugges simulations equations.

UNIT V
Introduction to the shells of Double curvatures:_ Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.

Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shell and hyperboloid of revolution cooling towers.

REFERENCES:

1 Design of concrete shell roofs By Billington – Tata MC Graw Hill, New York
2 Shell Analysis By N.K.Bairagi. Khanna Publishers, New Delhi.
3. Theory of Plates and Shells by Timoshenko- Tata MC Graw Hill, College
4. Analysis and design of concrete shell roofs By G.S.Ramaswami. CBS publications.
5. Design of concrete shell roofs By Chaterjee. Oxford and IBH.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

PG Electives

Elective – 1
1. Advanced Reinforced Concrete Design
2. Soil Dynamics and Machine Foundations
3. Advanced Foundation Engineering

Elective – 2
1. Experimental Stress Analysis
2. Advanced Structural Analysis
3. Forensic engineering structural evaluation and retrofitting of structures

Elective – 3
1. Stability of Structures
2. Composite Materials
3. Principles of Bridge Engineering

Elective – 4
1. Advanced Steel Design
2. Plastic Analysis and Design
3. Design of Industrial Structures

Elective – 5
1. Computer Oriented Numerical Methods
2. Optimization Techniques in Structural Engineering
3. Advanced Concrete Technology

Elective – 6

1. Design of Pre stressed Concrete Structures
2. Fracture Mechanics of Concrete Structures
3. Reinforced soil structures

Elective – 7
1. Rehabilitation and Retrofitting of Structures
2. Earthquake Resistant Design of Buildings
3. Computer aided design of structural engineering

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE - I
ADVANCED REINFORCED CONCRETE DESIGN

Objectives:
To impart knowledge on the behavior and design on various reinforced concrete structural elements.

Outcome:
The learner will be able to design the reinforced concrete elements like beams, slabs and compression members.

Prerequisites : Design of Reinforced Concrete Structures

UNIT I
Basic Design Concepts: Behavior in flexure, Design of singly Reinforced rectangular sections, Design of Doubly Reinforced rectangular sections, Design of flanged bean sections, Design for shear – Design for Torsion**,** Limit state of Serviceability**:** Deflections of Reinforced concrete beams and slabs short term deflections and long term deflection estimation of crack width in RCC members, calculation of crack widths.

UNIT II
Limit Analysis of R.C.Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, applications for fixed and continuous beam. Yield line analysis for slabs: Upper bound and lower bound theorems – yield line criterion – Virtual work and equilibrium methods of analysis – For square and circular slabs with simple and continuous end conditions.

UNIT III
Design of Ribbed slabs, Flat slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.
Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.

UNIT IV
Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels , Design of Nibs.

UNIT V
Design of Compression Members - Estimation of Effective Length of a Column – Code Requirements on Slenderness Limits,– Design of Short Columns Under Axial Compression – Design of Short Columns Under Compression With Uniaxial Bending – Design of Short Columns Under Axial Compression With Biaxial Bending – Design of Slender Columns.

Design of Combined Footings - Distribution of Soil Pressure - Geometry of Two-column Combined Footing – Design Considerations in Two-Column Footings.

REFERENCE:

1. "Reinforced Concrete Design" S. Unnikrishna Pillai & Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
2. "Advanced Reinforced Concrete" P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.
3. "Limit State Theory and Design of Reinforced Concrete" Dr. S. R. Karve and V.L Shah. Standard Publishers, PUNE 2004.
4. Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994.
5. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
6. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
7. "Design Reinforced Concrete Foundations" P.C. Varghese Prentice Hall of INDIA Private Ltd. .

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE - I
SOIL DYNAMICS AND MACHINE FOUNDATIONS

OBJECTIVE:

To understand the wave propagation in soils, determine dynamic properties of soil for analyzing and designing foundations subjected to vibratory loading.

OUTCOME:

Able to understand the fundamentals of wave propagation in soil media, evaluate the dynamic properties of soil, and design foundations for centrifugal and reciprocating machines.

Prerequisites : Soil Machines, Foundation Engineering and Structural Analysis

Unit. I

Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

Unit. II

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behaviour of cyclically loaded soils, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils: An introduction and evaluation using simple methods.

Unit. III

Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

Unit. IV

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

Unit. V

Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

Text Books

1. Das, B. M. - Principles of Soil Dynamics, PWS KENT publishing Company, Boston.
2. I.Chowdhary and S P Dasgupta - Dynamics of Structures and Foundation, 2009.

References:

1. Arya, S. D, O'Neil, M. and Pincus, G.- Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Co., 1979.
2. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.
3. Prakash, S. - Soil Dynamics, McGraw Hill, 1981.
4. Richart, F. E. Hall J. R and Woods R. D. - Vibrations of Soils and Foundations, Prentice Hall Inc., 1970
5. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publishing, 1999.
6. Kramer S. L. - Geotechnical Earthquake Engineering, Prentice Hall, 1996

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE - I

ADVANCED FOUNDATION ENGINEERING

Prerequisites: Foundation Engineering or Geotechnical Engineering-II

OBJECTIVE:

To determine the bearing capacity of shallow and deep foundations, to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

OUTCOME:

Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

UNIT – I

Bearing capacity of Footings subjected to Eccentric and Inclined Loading – Meyrhoff's and Hanse's theories – elastic settlement of Footings embedded in sands and clays of Infinite thickness – Footings on soils of Finite thickness-Schmertamaunn's method, Jaubu and Morgenstern method.

UNIT - II

Pile Foundations – settlement of Pile groups resting in sands and clays – Negative skin friction – in single piles and groups of piles – under – reamed piles – specifications – load – carrying capacity in sands and clays.

UNIT – III

Caissons and well foundations : Types of caissons – well foundation Different shapes of wells – Components of wells – functions and Design – Design Criteria – Sinking of wells – lateral stability by Terzaghi's analysis.

UNIT – IV

Cantilever sheet piles and anchored bulkheads Earth pressure diagram – Determination of Depth of embedment in sands and clays – Timbering of trenches- Earth pressure diagrams – Forces in struts.

UNIT - V

Foundations in Expansive soils – Problems in Expansive soils – Mechanism of swelling – Swell Pressure and Swelling potential – Heave foundation practices – Sand cushion – CNS cushion – under –reamed pile Foundations – Granular pile – anchor technique, stabilization of expansive soils.

References:

1. Analysis and Design of Substractenes – Swami Saran
2. Basic and Applied Soil Mechanics – Gopal Ranjan and A.S.R.Rao
3. Soil Mechanics & Foundation Engineering, Foundation Engineering – II - V.N.S. Murthy.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE - II

EXPERIMENTAL STRESS ANALYSIS

Objectives:
To impart knowledge on the strain measurement, brittle coating and photo elasticity.

Outcomes: The learner will be able to understand the properties of strain-gauge systems and the computation techniques.

Prerequisites: Strength of Materials I & II

UNIT I
Basic equations and Plane Elasticity Theory: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two dimensional State of Stress. The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function-Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms.

Principles of Experimental Approach: Merit of Experimental Analysis introduction, uses of experimental stress analysis-Advantages of experimental stress analysis, Different methods, Simplification of problems.

UNIT II
Strain Measurement using Strain Gauges: Definition of strain and its relation to Experimental Determinations, properties of strain-gauge systems, Types of strain gauges, Mechanical and Optical strain gauges. Electrical Strain Gauges- Introduction, LVDT - resistance strain gauge - various types - gauge factor, Materials for adhesion base, etc.

Strain Rosettes: Introduction, The three element rectangular Rosette - The delta rosette - Corrections for Transverse strain effects.

UNIT III
Brittle Coating Method: Introduction, Coating stresses - Failure theories - Brittle coating Crack pattern - Crack detection - Types of Brittle coating - Test procedures for brittle coating analysis - Calibration procedures - Analysis of brittle coating data.

UNIT IV
Theory of Photo Elasticity: Introduction, Temporary double refraction - The stress optic law - Effects of stressed model in a Polaris cope for various arrangements - Fringe sharpening, Brewster stress optic law.

UNIT V
Two Dimensional Photo Elasticity: Introduction, Isochromatic Fringe patterns - Isoclinic fringe patterns, passage of light through plane Polaris cope and circular Polaris cope, Isoclinic fringe pattern - Compensation techniques - calibration methods, separation methods, scaling Model to Proto type stress- Materials for photo - elasticity, properties of photo elastic materials.

Text Books :

1. Experimental Stress Analysis by J.W.Dally and W.F.Riley - Dover Publications
2. Experimental Stress Analysis by Dr. Sadhu Singh - Khanna Publishers

References :

1. Experimental Stress Analysis by Dove and Adams - Macmillan Publishing Company

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE – II

ADVANCED STRUCTURAL ANALYSIS

Objectives:
To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portal frames.

Outcome:
The learner will be able to analyse different indeterminate structures using Matrix methods.

Prerequisites : Structural Analysis I & II

UNIT I
Introduction to matrix methods of analysis - statically indeterminacy and kinematics indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element.
Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

UNIT II
Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - bank matrix - semi bandwidth - computer algorithm for assembly by direct stiffness matrix method.

UNIT III
Analysis of plane truss - continuous beam - plane frame and grids by flexibility methods.

UNIT IV
Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

UNIT V.
Special analysis procedures - static condensation and sub structuring - initial and thermal stresses.
Shear walls- Necessity - structural behavior of large frames with and without shear walls - approximate methods of analysis of shear walls.

Text Books:

1. Matrix methods of structural analysis by William Weaver and gere,CBS Publishers
2. Advanced Structural Analysis by A K Jain ,Nemchand Publishers

References:

1. Advanced Structural Analysis by Devdas Menon,Narosa publishing house
2. Matrix methods of structural analysis by Pandit and gupta
3. Matrix methods of structural analysis by J Meek
4. Strucutral Analysis by Ghali and Neyveli

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE – II

FORENSIC ENGINEERING STRUCTURAL EVALUATION AND RETROFITTING OF STRUCTURES

Pre-requisites : Advanced Concrete Technology

Course objectives:

To provide students with basic principles of failure mechanisms in cementitious materials, timbers, and metals in order to diagnose the causes of building defects. The various testing methods for concrete and structural evaluation as well as strengthening techniques are also included. Many case studies will be introduced and discussed.

Outcomes:

1. Describe and evaluate the use of structural forensics in creating and maintaining resilient stock of urban civil infrastructure.
2. Identify common failure modes of structures and classify them according to criticality/risk.
3. Classify an observed structural failure as a technical or procedural failure or a combination.

Unit I:

Introduction: Disasters and their effects, Role of the expert witness, Methods of forensic analysis, Distress in concrete structures, Deterioration of structures-Causes and prevention, Damage assessment procedure

Unit II:

Failure Mechanisms in Materials Introduction,. Chloride attack of concrete. Carbonation of Concrete, Sulphate attack, Defects in timber, alkali silica reaction, Defects in timber, Fungal attack of timber, Insect attack of timber, Corrosion of steel, Galvanic action

Unit III :

Performance of structures Introduction: Factors affecting life performance, measures to improve performance, Deterioration model, Testing methods for concrete evaluation, Condition survey procedure, Non destructive techniques, Evaluation of existing buildings, Investigation techniques

Unit IV:

Maintenance of concrete structures and materials Introduction: Maintenance requirement and planning, classification of maintenance, Repair materials and techniques, Safety measures in maintenance works

Unit V :

Strengthening and Stabilization Introduction: Techniques/design consideration, Beam shear capacity strengtheningShear transfer strengthening between members, Stress reduction techniques ,Column strengthening, Flexural strengthening, Connection stabilization and strengthening Crack stabilization

Text Books :

1. Maintenance and repair of civil structures, B.L.Gupta and Amit Gupta,Standard publishers
2.Concrete Technology by A.R.Shantakumar, Oxford university press

REFERENCES:

1. The Technology of Building Defects, E F & N Spon, London. Peter H. Emmons, (1993)
2. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ransom, (1981)
3. 3. Building Failures: Diagnosis and Avoidance, E F & N Spon, London. B. A. Richardson, (1991):
4. Defects and Deterioration in Buildings, E F & N Spon, London.

Non-Destructive Evaluation of Concrete Structures by Bungey

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PG ELECTIVE – III

STABILITY OF STRUCTURES

Objectives:

To impart knowledge on the elastic, inelastic buckling and torsional buckling of structures.

Outcomes:

The learner will be able to understand buckling of bars and frames.

Prerequisites : Theory of Elasticity & Advanced Structural Analysis

UNIT – I

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads – continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load – application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowable stresses.

UNIT - II

Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built up columns.

UNIT - III

In Elastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design – various end conditions

UNIT - IV

Torsion Buckling: Pure torsion of thin walled bars of open cross section – Non-uniform torsion of thin walled bars of open cross section- Torsional buckling – Buckling by torsion and flexure.

UNIT – V

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

Text Books :

1. Theory of elastic Stability by Timshenko & Gere-Mc Graw Hill

References

1. Stability of metallic structures by Blunch- Mc Graw Hill
2. Theory of Beam- Columns Vol I by Chem. & Atste Mc. Graw Hill

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PG ELECTIVE – III

COMPOSITE MATERIALS

Objectives:

To impart knowledge on the properties of composite materials, their uses and advantages.

Outcomes:

The learner will be able to understand use of different composite materials and design GRP Box beams.

Prerequisites : Reinforced Concrete Design

UNIT - I

Introduction: Requirements of structural materials, influence of nature of materials in structural form, Nature of structural materials- Homogeneous materials, composite materials.

UNIT - II

Macro mechanical Properties of composite Laminae: Introduction, Assumptions and Idealizations, Stress Strain relationships for composite Laminae- Isotropic, Orthotropic laminae, Strength Characteristics- Basic concepts, Strength hypothesis for isotropic and Orthotropic laminae. Macro mechanical Analysis of composite Laminae: Introduction, Assumptions and Limitations, Stiffness characteristics of glass reinforced laminae- Stress- Strain relationships in continuous, discontinuous fibre laminae, Strength characteristics of glass reinforced laminae- Strengths in continuous, discontinuous fibre laminae.

UNIT - III

Behaviour of Glass Fibre-Reinforced laminates: Introduction, Stiffness characteristics of Laminated composites- Behaviour of Laminated beams and plates, Strength characteristics of Laminated composites- Strength analysis and failure criteria, Effect of inter laminar structures. Glass Reinforced Composites: Introduction, Continuously reinforced laminates- uni-directionally and multi directionally continuously reinforced laminates, Discontinuously reinforced laminates – Stiffness and Strength properties.

UNIT - IV

GRP properties relevant to structural Design: Introduction, Short-term strength and stiffness-Tensile, Compressive, Flexural and Shearing. Long term strength and stiffness properties, Temperature effects, Effect of fire, Structural joints- Adhesive, mechanical, Combinational, Transformed sections.

UNIT - V

Design of GRP Box Beams: Introduction, loading, span and cross-sectional shape, Selection of material, Beam manufacture, Beam stresses, Experimental Behaviour, Effect on Beam performance- Modulus of Elasticity, Compressive Strength, I value, prevention of compression buckling failure, Behaviour under long term loading.

Design of Stressed skinned roof structure: Introduction, loading and material properties, preliminary design, and computer analysis.

Text Books :

1. Mechanics of Composite materials and Structures by Madhujith Mukhopadhyay; Universities Press

Reference:

1. GRP in Structural Engineering M.Holmes and D.J.Just - Applied Science Publishers

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PG ELECTIVE – III

PRINCIPLES OF BRIDGE ENGINEERING

Objectives:

To impart knowledge about different types of bridges, their analysis and design for combination of different loading condition as per codal provisions.

Outcomes:

The learner will be in a position to understand and design different types of bridges.

Prerequisites : Structural Analysis I &II, Reinforced Concrete Design

UNIT I.

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Sesmic loads- Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway and footway-General Design Requirements.

UNIT II.

Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT III

Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

UNIT IV.

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestessed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT V.

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-srtucture of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers-Abutments- Design loads for Abutments.

References

1. Design of Concrete Bridges by M.G.Aswani, V.N.Vazirani and M.M.Ratwani.
2. Bridge Deck Behaviour by E.C.Hambly.
3. Concrete Bridge Design and Practice by V.K.Raina.

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PG ELECTIVE – IV

ADVANCED STEEL DESIGN

Objectives:
To impart knowledge on behavior and design of various connections, industrial and steel girders.

Outcomes: The learner will be able to design different steel structures.

Prerequisites : Design of Steel Structures & Structural Analysis

UNIT I:
SIMPLE CONNECTIONS – RIVETED, BOLTED PINNED AND WELDED CONNECTIONS : Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT II:
ECCENTRIC AND MOMENT CONNECTIONS : Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT III: ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS:
Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform.Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT IV: DESIGN OF STEEL TRUSS GIRDER BRIDGES:
Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal
Bracing; sway bracing.

UNIT V: DESIGN OF STEEL BUNKERS AND SILOS :
Introduction – Janssen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom – Design of Bins.

References:

1. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
2. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientitic Publishes Journals Department..
3. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. NewDelhi.
4. Design of Steel Structures Galyord & Gaylord, Publisher : Tata Mc Graw Hill, Education. Edition 2012.
5. Indian Standard Code – IS – 800-2007.

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PG ELECTIVE – IV

PLASTIC ANALYSIS AND DESIGN

Objectives:
To impart knowledge on the analysis of steel structures like continuous beams, steel frames and connection, using Plastic Analysis.

Outcomes:
The learner will be able to design continuous beams and steel frames.

Prerequisites : Design of Steel Structures & Structural Analysis I & II

UNIT – I
Analysis of Structures for Ultimate Load: Fundamental Principles – statical method of Analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor – Moment Balancing Method.

UNIT - II
Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

UNIT - III
Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – column stability.

UNIT - IV
Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT - V

Design of Steel Frames: Introduction – Sinole span frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections: Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

Text books & References:

1. Plastic Design of Steel Frames, L.S.Beedle - John Wiley & Sons.
2. Plastic Analysis, B.G.Neal - Chapman & Hall
3. Plastic Analysis, Horve.

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PG ELECTIVE – IV

DESIGN OF INDUSTRIAL STRUCTURES

Objectives:

To impart knowledge about different types of industrial structures their analysis and design for different conditions as per codal provision.

Outcomes:

The learner will be able to plan different types of industrial structures such as cold framed members, RC buckers, Soil, Chimneys. Cylindrical shells and design them.

Prerequisites : Design of Steel Structures & Structural Analysis

Unit1.
Planning of Industrial Structures – types of industrial structures – different components of industrial structures – loads.

Unit 2.
Design of Single & Multi-bay Industrial Structures in Concrete & Steel.

Unit 3.
RC Bunkers & Silos : loads – Design parameters – Design principles.

Unit 4.
RC Chimneys : loads – Design parameters – Design principles

Unit 5.
Hyperbolic Cooling Towers : Loads – Design parameters – Design principles

Text Books & References:

1. Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers & Distributors).
2. Design of Steel Structures, By B.C.Punmia, A.K.Jain – Laxmi Publications
3. Design of Steel Structures, By Ram Chandra - Scientific Publishers
4. Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers

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PG ELECTIVE – V

COMPUTER ORIENTED NUMERICAL METHODS

Objectives:

To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

Outcome:

The learner will be able to apply various mathematical techniques to Structural engineering problems.

Prerequisites : Mathematics I & II

UNIT I:

Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method. Eigen values and eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

UNIT II:

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

Unit III

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series-Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation-Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations

UNIT IV.

Numerical Differentiation: Finite Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method.

UNIT V

Ordinary Differential Equation: Euler's method – Backward Euler method – Mid point method – single step method, Taylor's series method- Boundary value problems.

Text Books:

1. Numerical methods for scientific and engineering computations. M.K.Jain-S.R.K.Iyengar – R.K.Jain Willey Eastern Limited.
2. Numerical methods by S.S.Shastry. PhiPublishers
3. Numerical Methods for Engineering Problems by N. Krishna Raju and K.U. Murthy, M.C. Millan Publisher, New Delhi.

References:

1. Applied numerical analysis by – Curtis I.Gerala- Addission Wasley – published campus.
2. Numerical methods for Engineers Stevan C.Chopra, Raymond P.Canal Mc. Graw Hill book company.
3. C Language and Numerical methods by C.Xavier – New age international publisher.
4. Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers, New Delhi.

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PG ELECTIVE – V

OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING

OBJECTIVE:

To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.

OUTCOME:

The student will be able to understand the basic principles of optimization, and in a position to formulate optimization models for a wide range of civil engineering problems and able to solve them.

Prerequisites : Mathematics I&II

UNIT 1

Introduction to Optimization: Introduction - Historical developments - Engineering applications of Optimization - Statement of an Optimization problem - Classification of Optimization problems - Optimization Techniques. Optimization by calculus: Introduction - Unconstrained functions of a single variable - Problems involving simple constraints - Unconstrained functions of several variables - treatment of equality constraints - Extension to multiple equality constraints - Optimization with inequality constraints - The generalized Newton-Raphson method.

UNIT II

Linear Programming: Introduction - Applications of linear programming - standard form of a linear programming problem - Geometry of linear programming problems - Definitions and theorems - Solution of a system of Linear simultaneous equations - Pivotal reduction of a general system of equations - Motivation of the Simplex Method - Simplex Algorithm - Two phases of the simplex method. non-Linear Programming: Introduction - Unimodal Function - Unrestricted search - Exhaustive search - Dichotomous search - Interval Halving method - Fibonacci method - Golden section method - Comparison of elimination methods - Unconstrained optimization techniques - Direct search methods - Random search methos - grid search method - Univariate method - Powell's method - Simplex method - Indirect search methods - Gradient of a function - Steepest descent method - Conjugate gradient - Newton's method.

UNIT III

Dynamic Programming: Introduction - Multistage decision processes - concept of sub-optimization and the principle of optimality - computational procedure in dynamic programming - example illustrating the Calculus method of solution - example illustrating the Tabular of solution - conversion of a final value problem into an initial value problem - continuous dynamic programming - Additional applications.

UNIT IV

Network Analysis: Introduction - Elementary graph theory - Network variables and problem types - Minimum-cost route - Network capacity problems - Modification of the directional sense of the network.

UNIT V

Application of Optimization techniques to trusses, Beams and Frames.

Text Books:

1. Introduction to Optimum Design by J.S.Arora. McGraw Hill New York
2. Optimization: Theory and Applications by S.S.Rao.Wiley & Sons

References

1. Numerical Optimization Techniques for Engineering Design with applications by G.N.Vanderplaats. McGraw-Hill, New York
2. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal. Kluwer Academic Publishers, Dordrecht, 1992
3. Optimum Structural Design by U.Kirsch. McGraw-Hill, New York
4. Optimum Design of Structures by K.I.Majid. Wiley, New York

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PG ELECTIVE – V

ADVANCED CONCRETE TECHNOLOGY

Objectives:

To impart knowledge on concrete making materials, concrete mix design for proportioning and their testing.

Outcomes:

The learner will be able to design concrete mixes of different grades and also use the special concretes.

Prerequisites : Concrete Technology

UNIT – I

High strength concrete – Micro structure – Manufacturing considerations – selection of mix proportions – Design of high strength concrete by Erintroy method –properties of high strength concrete – advantages and applications – ultra high strength concrete.

UNIT – II

Self compacting concrete – definition – requirement – manufacturing considerations – tests of fresh and hardened concrete – EFNARC guide lines – design of mix proportions – advantages and applications.

UNIT – III

Polymers in concrete – different types – proportioning polymer concrete – tests on polymer concrete – High performance concrete – requirements and characteristics factors controlling performance and mechanism affecting performance – mix design methods

UNIT – IV

Form work – materials – structural requests – form work systems – connections – specifications – design of form work – shores – removal for forms and shores – reshoring – failure of form work.

UNIT – V

Concrete mix design-BIS method – ACI method – DOE method – Light weight aggregate concrete.

TEXT BOOKS

1. Properties of Concrete by A.M.Neville, ELBS publications.
2. Concrete Technology by A.K. Santhakumar, Oxford University Press.
3. Concrete Technology by M.S.Shetty, S.Chand & Co.

REFERENCES:

1. Special Structural concretes by Rafat Siddique, Galgotia Publications.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.
3. Concrete: Micro Structure by P.K.Mehta, ICI, Chennai

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PG ELECTIVE – VI

DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Objectives:

To impart knowledge on basics of prestressing and designing of different structural elements using Prestressing techniques.

Outcomes:

The learner will be able to understand the prestressing techniques, design the various structural elements using Prestressing techniques.

Prerequisites : Reinforced Concrete Design & Structural Analysis

UNIT I:

Design of Prestressed Concrete Sections- Design of sections for flexure, Minimum section modulus- prestressing force- Limitation of prestress in long spans- limiting zone for the prestressing force- Design of sections for the limit state of collapse in flexure-Design of sections for axial tension.

UNIT II:

Statically Indeterminate Structures: Primary and secondary moments – methods of Analysis of secondary moments. –Analysis of continuous beams and simple portal frames (single bay and single storey)

Composite Beams: Different Types- Propped and Unpropped- stress distribution- Differential shrinkage- Analysis of composite beams- General design considerations.

UNIT III:

Design of sections for Compression and Bending: Load- Moment Interaction curves for prestressed concrete short columns-Design of long prestressed columns-design of prestressed concrete compression members in biaxial bending- practical design considerations-design of prestressed sections for shear and torsion.

UNIT IV:

Prestressed Concrete Slabs: Types of prestressed concrete floor slabs- design of prestressed concrete one way and two way slabs—design of prestressed concrete simple flat slabs and continuous flat slab floors.

UNIT V:

Prestressed Concrete Pipes, Tanks, Poles and Piles: Circular prestressing- Types of prestressed concrete pipes- Design of prestressed concrete pipes- analysis and design of prestressed concrete tanks-Design of prestressed concrete poles, partially prestressed pretensioned poles-advantages of prestressed concrete piles- types of prestressed concrete piles- design considerations- pile reinforcements- pile shoes-sheet piles.

References :

1. Prestressed concrete by Krishna Raju, Tata Mc Graw Hill Book – Co ., New Delhi.
2. Design of prestress concrete structures by T.Y. Lin and Burn, John Wiley, New York.
3. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.

Prestressed Concrete by N. Rajagopalan Narosa Publishing House

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PG ELECTIVE – VI

FRACTURE MECHANICS OF CONCRETE STRUCTURES

Objectives:

To impart knowledge on the mechanisms of failure and non linear fracture mechanics.

Outcomes:

The learner will be able to understand the behavior of concrete with tension and compression failure surfaces and concepts of CTOD and CMD.

Prerequisites : Concrete Technology Strength of Materials I & II

UNIT I

Fundamentals of Fracture Mechanics, Mechanisms of fracture and crack growth

UNIT II

Cleavage fracture, ductile fracture, fatigue cracking, Environment assisted cracking, Quasi brittle materials.

UNIT III

Service failure analysis, linear elastic fracture mechanics, Griffith's criteria, stress intensity factors, crack tip plastic zone, Erwin's plastic zone correction, R curves, compliance, J Integral, nonlinear analysis ,Review of concrete behaviour in tension and compression, Basic frameworks for modeling of quasibrittle materials.

UNIT IV

Nonlinear Fracture Mechanics – Discrete crack concept/Smeared crack concept, Size effect, Plasticity models for concrete – Associated and non-associated flow, Failure surfaces for quasibrittle materials.

UNIT V

Concept of CTOD and CMD, Material models, crack models, band models, models based on continuum damage mechanics

Text books:

1. Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.
2. Venkataraman and Patel "Structural Mechanics with introduction to Elasticity and Plasticity" – Mcgraw Hill, 1990.
3. Shanes – "Introduction to Solid Mechanics – II Edition, PH, 1989.

Reference books :

1. Elementary engineering fracture mechanics – David Broek – Sijthoff & Noordhoff – Alphen aan den Rijn – Netherlands
2. Fracture mechanics of concrete structures – Theory and applications – Rilem Report – Edited by L. Elfgreen – Chapman and Hall – 1989.
3. Fracture mechanics – applications to concrete – Edited by Victor, C. Li, & Z.P. Bazant – ACI SP 118.

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PG ELECTIVE – VI

REINFORCED SOIL STRUCTURES

Prerequisites: Soil Mechanics & Foundation Engineering or Geotechnical Engineering-I &II

OBJECTIVE:

To study the various retaining structures and design the earth retaining structures used in construction of road/railways/pipe lines/open excavations.

OUTCOME:

Able to design conventional/Reinforced earth retaining walls, sheet pile walls, bracing system for open excavations.

UNIT-I

Reinforced Earth: History, field of applications, natural fibres, overview of Geotextiles, Geomembranes, Geogrids, Geonets, Geowebs, Geomats and Gecompsites, economic aspects of their applications.

UNIT-II

Production of Geotextiles, composites, physico-mechanical, hydraulic and chemical Properties. Functions of Geosynthetics, fluid transmission, filtration, separation, protection.

UNIT-III

Soil Reinforcement: Basic principle of soil reinforcement, shear strength of reinforced soil, theoretical strength models, factors affecting, requirements on synthetic reinforcement, installation techniques.

UNIT-IV

Calculation methods: Basic concepts, embankment on soft soils, internal stability, overall stability, foundation stability and bearing capacity failures Construction of the steep slope, retaining walls-external stability, internal stability.

UNIT-V

Use of Geosynthetics in Roads and Railways, drainage system- Control of groundwater level, dewatering and reclamation of land, use of Geomembranes – For lining applications, management and maintenance.

Text Books:

1. Reinforced Soil and Geo-textiles- J. N. Mandal, proceedings FIGC- 1988, Oxford and IBH publishing company private Ltd., New Delhi.

References:

1. Geo-textiles and Geo-membranes in Civil Engg. Gerard P.T.M. Van Santvrot A. A. Balkema, Oxford and IBH publishing company, New Delhi.
2. Geosynthetics: Applications, Design and construction- R. J. Tarmat, proceedings First Europian Geosynthetics Conference, Netherland A. A. Balkema, publisher-Brookfield, U.S.A.
3. Geosynthetics World. – J. N. mandal, Willey Eastern Limited, New Delhi.

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PG ELECTIVE – VII

REHABILITATION AND RETROFITING OF STRUCTURES

Objectives:

To impart knowledge about different types of determination of structures testing the structures for the deter ration of structures testing the structures for the diagnosis defects and different types of repairing methods.

Outcomes:

The learner will be understand about different types of distresses in structures, their causes, testing of structures for different problems and suggest suitable repair method.

Prerequisites : Reinforced Concrete Design, Steel Design, Concrete Technology

UNIT – I

Introduction – Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage.

UNIT – II

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desication.

UNIT – III

Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment – NDT.

UNIT – IV

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – VIII

Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

TEXT BOOKS:

1. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
2. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991).

REFERENCES

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildingts, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.

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PG ELECTIVE – VII

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

Objectives:
To impart knowledge on the seismology and behavior of buildings during earthquakes.

Outcomes : The learner will be able to analyse and design buildings to resist seismic forces.

Prerequisites : Structural Dynamics, Reinforced Concrete Design

UNIT - I
Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics-Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India.

UNIT - II
Conceptual design: Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships-flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete-masonry-reinforcing steel. Introduction to earthquake resistant design: Seismic design requirements-regular and irregular configurations-basic assumptions-design earthquake loads-basic load combinations-permissible stresses-seismic methods of analysis-factors in seismic analysis-equivalent lateral force method-dynamic analysis-response spectrum method.

UNIT - III
Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members- Structural models for frame buildings- Seismic methods of analysis- Seismic deign methods- IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical irregularities- Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces-Equivalent lateral force procedure- Lateral distribution of base shear. **Masonry Buildings**: Introduction- Elastic properties of masonry assemblage- Categories of masonry buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses- Seismic design requirements- Lateral load analysis of masonry buildings.

UNIT - IV
Structural Walls and Non-Structural Elements: Strategies in the location of structural walls-sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements- Prevention of non-structural damage- Isolation of non-structures.

UNIT - V
Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes.

Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

TEXT BOOKS:

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

REFERENCES:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
2. Eartquake Resistant Design of Buidling structures by Vinod Hosur, Wiley India Pvt. Ltd.
3. Masory and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Bros
4. Earthquake Tips – Learning Earthquake Design and Construction C.V.R. Murty

Reference Codes:

1. IS: 1893 (Part-1) -2002. "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS:4326-1993, " Earthquake Resistant Design and Construction of Building", Code of Practice B.I.S., New Delhi.
3. IS:13920-1993, " Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

. **JNTUH COLLEGE OF ENGINEERING HYDERABAD**

IDP (B.Tech. Civil Engg. & M.Tech)

PG ELECTIVE – VII

COMPUTER AIDED DESIGN OF STRUCTURAL ENGINEERING

Objectives:
To impart knowledge on the use of various software's for analysis of Structures

Outcomes:
The learner will be able to understand and design the structures using the software.

Prerequisites: Advanced Structural Analysis, Auto CAD

UNIT I
Introduction to computer aided design-An over view-computer as a design medium hardware components of a computer -programming languages.
C - Programming language-Introduction-An over view of programming in C-variables and data types-Declaration of variables-Initialization of variables-operators-arithmetic operators- precedence and associability-Input and output-Character I/O-Formatted output. Print f ()-Formatted input scan f ()-Examples.

UNIT II
C Programming Language-Control structures-If statement-Switch statement-loops-nested loops-while and for ,Do-While-continue statement-Go to statement-Examples.
C Programming Language-Arrays-One dimensional Arrays-Two Dimensional Arrays-pointer operators-pointer arithmetic-pointers and arrays-Matrix manipulations using arrays and pointers-pointers to functions-data files-basic operations-reading and writing and file accessing files-examples.

UNIT III
Computer Graphics-introduction-applications graphic devices-display devices-output and input devices-two dimensional geometric transformations-homogeneous co-ordinates-world co-ordinates-device co-ordinates-window to view port-transformations-clipping operations.

UNIT IV

Data base management system-introduction-data base systems-hardware-software-users-operational data independence-architecture of data base system-distributed databases.

UNIT V

Knowledge based expert system-introduction-artificial intelligence-components of an expert system-stages in expert system development-knowledge representation-inference mechanisms-applications.

Text Books:

1. Computer Aided Design by C.S.Krishnamoorthy and S.Rajeev – Narosa publishers

References

1. Computational Structures by S.Rajasekharan – publishers Springer-Verlag London