Faculty of Engineering

Scheme of Instruction and Syllabi of

B.E. III –YEAR

of

FOUR YEAR DEGREE COUSE

IN

CIVIL ENGINEERING

(With effect from the Academic Year 2015-2016)

July 2015

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(Autonomous)

Gandipet, Hyderabad -500 075

WITH EFFECT FROM THE ACADEMIC YEAR 2015-2016

SCHEME OF INSTRUCTION & EXAMINATION

B.E. III -YEAR
CIVIL ENGINEERING

I - SEMESTER

S. No	Syllabus Ref.No	SUBJECT	Scheme of Instruction			Scheme of Examination			Credits
			Periods per Week			Duration in Hrs	Maximum Marks		
			L	T	D/P		University Exam	Sessionals	
		THEORY							
1	CE 311	Reinforced Concrete Design-I	4	2	0	3	75	25	4
2	CE 312	Fluid Mechanics - II	4	0	0	3	75	25	3
3	CE 313	Theory of Structures-I	4	2	0	3	75	25	4
4	CE 314	Building Planning and Services	3	0	2	3	75	25	3
5	CE 315	Transportation Engineering	4	0	0	3	75	25	3
6	CE 316	Water & Waste Water Engg.	4	0	0	3	75	25	3
7	CE 444	Human Values and Professional Ethics	21 (7*3) periods / Semester			2	50	------	------
		Theory Total	23	4	2	----	500	150	21
		PRACTICALS							
1	CE 317	Hydraulics and Hydraulic Machinery Lab	0	0	3	3	50	25	2
2	CE 318	Transportation Engg. Lab	0	0	3	3	50	25	2
3	EG 221	Soft Skills and Employability Enhancement	0	0	2	3	50	25	1
4	CE 227	Surveying Camp	0	0	0	0	0	50*	2*
		Practicals Total	0	0	8	-----	150	125	7
Grand Total (Theory +Tutorial + Practicals)			23	4	10	----	650	275	27

L=Lecture , T=Tutorial, D/P= Drawing/Practical

***These marks & credits are actually awarded in the II-Year II-Semester in the Survey camp held normally during the last week(s) of Summer vacation . As the results of II year II Semester are declared by that time , these marks are to be entered here in the III year I Semester.**

CE 311 REINFORCED CONCRETE DESIGN-I

Instructions per week	: 4 (Th)+ 2 (T)
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 4

Course Objectives:

To enable the student

1. Understand the applications of concrete, basic requirements of concrete structures and learn the fundamentals of design philosophies.
2. Familiarize with relevant codes of practice, professional approaches and field problems
3. Design various RC Structural elements such as beams , slabs , columns and footings .
4. Acquire ability to draw, understand and interpret the structural drawings for various RC elements such as beams, slabs , columns and footings, including aspects of detailing.

Course Outcomes:

At the end of the coursethe student

1. Is able to use and suggest concrete for various practical applications.
2. Is able to interpret various specifications of relevant standards, to field problems and professional practices.
3. Is able to design a beam, slab, column and footing, compare various design options for a given RC element and arrive at a better design solution
4. Interprets and communicates the design detail of RC beams , slabs , columns and footings , through appropriate structural drawings.

(Note: All relevant IS codes necessary for teaching this course may be introduced and referred in detail by the Faculty concerned)

UNIT-I: Introduction to Reinforced Cement Concrete:

Applications of Concrete – Need for Reinforcement in Concrete – Types and Properties of Concrete and Steel – Tests on concrete and steel – RCC as a material – Basic requirements of an RCC Structure – stability, strength, serviceability and durability.

Design philosophies:Development of design philosophies-Working stress method(WSM), Ultimate load method, and Limit state method (LSM) relative merits and demerits. Basic concepts and characteristics loads and strengths, Partial safely factors. Stress strain relationship for concrete and steel; stress blocks (generalized, rectangular, parabolic and Whitney's).

Working stress method: Theory of bending in RCC beams, balanced, under-reinforced and over reinforced sections; Analysis and design of singly and doubly reinforced rectangular and flanged sections.

UNIT-II: Limit state of collapse (flexure): Assumptions, Analysis and design for flexure failure in tension and compression singly reinforced, doubly reinforced rectangular and flanged beams. Anchorage and development length, Curtailment of reinforcement in beams.

UNIT-III: Limit state of collapse in shear and torsion: Analysis and design for shear and torsion.
Limit states of serviceability: Short term, long term and total deflections,check for deflection and cracking.

UNIT-IV: Analysis and design of slabs: Definition of a Slab – Types of Slabs – one way, two way simply supported and continuous rectangular slabs subjected to only uniformly distributed loads. IS Code method - Design of solid rectangular slabs as per IS 456; Detailing of reinforcement in slabs, Check for serviceability of slabs. Introduction to Yield line theory for Slabs - Assumptions –Patterns of Yield lines – Analysis and design of a simply supported rectangular two way slab using yield line approach.

Design of stairs: Design and detailing of dog legged stairs.

UNIT-V: Analysis and design of columns: Assumptions, axially loaded circular, square and Rectangular columns, Uniaxial and biaxial bending of columns- subjected to a axial load & bending.
Analysis and Design of Footings: Design of isolated square, rectangular and circular footings as per IS code.

Text Books:

1. N.Subramanian "Design of Reinforced Concrete Structures" Oxford University Press. First Published in 2013,Second impression 2014
2. Unni Krishnan Pillai and DevadassMenon,"Reinforced Concrete Design" ,Tata McGraw-Hill Publishing Co Ltd,1998.

Suggested Reading:

1. V.L.Shah&S.R.Karve ,"Limit State Theory and Design of Reinforced Concrete", Structures Publications,7th Edition,2014.
2. A.K. Jain, Limit State Design of Reinforced Concrete, Nem Chand & Bros., 1998
3. Sushil Kumar, Treasure of RCC Designs, Standard Book House,1998.
4. Krishna Raju, N., Design of Reinforced Concrete Structures, CBS Publishers and Distributors, New Delhi, 1989
5. Sinha N.C. and Roy S.K; Fundamentals of Reinforced Concrete, S.Chand& Co., 2001.

CE 312 FLUID MECHANICS - II

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 3

Course Objectives:

To enable the student

1. Understandand analyse the steady, uniform and non-uniform flows through open channels and unsteady flow through pipes.
2. Expose to the basics of computation of Aerodynamic forces (drag and lift forces) and dimensional analysis in experimental hydraulics.
3. Familiarizewith various types of hydraulic machinery (turbines and pumps) their functioning and efficiency.
4. Pursue higher studies and research programmes in the field of fluid mechanics.

Course Outcomes:

At the end of the course, the student

1. Applies the concepts of open channel flow and pipe flow to the field problems.
2. Interprets the basics of computation of drag and lifts forces in the field of aerodynamics and applies method of "dimensional analysis" to the field of experimental hydraulics.
3. Applies the momentum and energy concepts in the design of turbines and pumps.
4. Selects fluid mechanics as one of the options for pursuing higher studies and research.

UNIT – I :Steady uniform flow through open channels: Definitions, differencebetween pipe flow and channel flow, velocity and pressure distributions inchannel crosssection, energy and momentum correction coefficients, friction to flow in open channels,uniform flow, Manning and Chezy formulae, most efficient channel cross-section,specific energy and specific force, concept of critical depth and its applications.

UNIT-II: Non-uniform flowthrough open channels: Significance of Froude Number, dynamic equation of graduallyvaried flow, classification of gradually varied flow profiles, computation of flow profilesand characteristics of flow profiles. Hydraulic Jump- Momentum equation for a jump inhorizontal rectangular channel, energy dissipation in hydraulic jump, surges in openchannels, elementary surge analysis.

UNIT-III: Unsteady flow in pipes: Water hammer phenomenon, pressure rise due to gradual andsudden valve closure, critical period of the pipeline. Boundary layer-Definition, laminarand turbulent boundary layers, boundary layer growth and separation.

Drag and lift: Drag and lift forces, Principle of stream lining, bluff body and streamlined body, Drag on Airfoil, Magnus effect.

UNIT-IV: Dimensional analysis and models studies: Dimensional analysis as a tool inexperimental hydraulics, Buckingham method, applications; geometric, kinematicsand

dynamic similarity, similarity laws; significance of Reynold's, Froude and Mach numbers, Different types of models and their scale ratios, scale effect in models.

UNIT-V: Hydraulic turbines: Classification, specific speed, unit quantities velocity triangles andprinciples of design of reaction and impulse turbines, characteristics curves.
Centrifugal Pumps: Component work done and efficiency, minimum starting speed,Euler head equation, specific speed and characteristic curves of centrifugal pumps.

Text Books:

1. P.N.Modi&S.M.Sethi, Hydraulic and Fluid Mechanics, Standard Book House, Delhi, 11th Edition, 1995.
2. Street, R.L., Watters, G.Z. and Vennerd, J.K., "Elementary Fluid Mechanics", 7th Edition, John Wiley International Publications, 1996
3. K. Subramanya, Flow in Open Channels, Tata McGraw-Hill Education, 2009
4. Victor L. Streeter, E. Benjamin Wylie, Fluid Mechanics, Mcgraw-Hill Education, 1985

Suggested Reading:

1. Yunus A. Cengel& John M. Cimbla, Fluid Mechanics Fundamentals and Applications, Tata MsGraw Hill Education private Ltd, 2012
2. Subramanya K, "1000 solved problems in Fluid Mechanics", Tata MsGraw Hill Publications 2005
3. VenTe Chow, Open-Channel Hydraulics, McGraw-Hill, New York, 1959
4. A.K.Jain, Fluid Mechanics, Khanna Publishers, Delhi, 1993.

CE 313 THEORY OF STRUCTURES-I

Instructions per week	: 4 (Th) + 2 (T)
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 4

Course Objectives:

To enable the student

1. Calculate the degree of static and kinematic indeterminacy of a given structure such as beams, truss and frame.
2. Learn the analysis of arches(two and three hinged) andindeterminate beams and frames using various conventional methods.
3. Understand the concept of analysis of determinate trusses by various methods, to find the deflections and analyse redundant trusses.
4. Compare various methods of analysis and chose a best option.

Course Outcomes:

At the end of the course, the student will be

1. Able to find the degree of static and kinematic indeterminacy of structures.
2. Able to analyse three and two hinged arches for various loads and support positions and indeterminate beams and frames using various methods and can chose best suitable method for the given problem.
3. Able to analyse the trusses by various methods, can find deflections and analyse redundant trusses.
4. Able to compare various methods of analysis and select the best option for problem solving.

UNIT – I: Indeterminacy: Static indeterminacy and Kinematic indeterminacy. Determination of Static and Kinematic indeterminacies of beams, pin jointed and rigid jointed plane frames (2D problems only).

Elastic theory of arches: Eddy's theorem, three hinged parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading.

Two hinged arches: parabolic and segmental, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading and temperature effects.

UNIT - II: Slope deflection method: Analysis of

1) Continuous beams with and without sinking supports:
2) Single bay - single storied portal frames with and without side sway;

- Loading on each span may be point load(s) and uniformly distributed load on whole span.
- Sketching of shear force and bending moment diagrams.

UNIT-III: Moment distribution method: Analysis of

1) Continuous beams with and without sinking of supports;
2) Single bay single storied portal frames with and without side sway;

-Loading on beam/portal frame shall be point load(s) and uniformly distributed load on whole span
-shear force and bending moment diagrams.

UNIT – IV: Kani's method: Applied to continuous beams with and without sinking of supports; and single bay single storey portal frames with and without side way.
-Loading on beam/portal frame shall be point load(s) and uniformly distributed load on whole span
- Sketching of shear force and bending moment diagrams.

UNIT – V: Analysis of determinate pin jointed plane frames (trusses): ByMethod of joints and Method of sections.
Deflections: of statically determinate structure such as Pin and Rigid jointed plane frames (2D problems only) using Castigliano's theorem –I and Unit Load method.
Redundant pin-jointed trusses: Castigliano's theorem –II. Analysis of plane trusses with one degree of redundancy (internal / external), Assembly and temperature effects.

Text Books:

1. Ramamrutham.S, "Theory of Structures", DhanpathiRai Publishing Company (P) Ltd., 2014.
2. D.S. PrakashRao, "Structural Analysis" - A Unified Approach, University Press, 1996
3. T.S.Thandavamoorthy, "Structural Analysis":,Oxford Higher Education, Second Impression, 2012.

Suggested Reading:

1. S.B. Junarkar and Shah, "Mechanics of structures", Charotar Pub. House, 2001.
2. S.P. Gupta and G.S.Pandit, "Theory of Structures", Tata McGraw Hill, 1999
3. B.C. Punmia, Ashok Jain and Arun K. Jain, "Theory of Structures", Laxmi , Publication, 2000
4. R. C. Hibbeler, "Structural Analysis", 8/E, Prentice Hall, Higher Education, 2012.

CE 314 BUILDING PLANNING AND SERVICES

Instructions per week	: 3(Th) +2(T)
Duration of University Examination	: 3 hours
University Examinations	: 75 Marks
Sessionals	: 25 Marks
Credits	: 4

Course Objectives:

To enable the student

1. Understandas how various types of building services equipment work and how they are integrated into a building.
2. Draw a residential building plan.
3. Learn the aspects of acoustics of buildings
4. Understand the concept and importance of green buildings

Course Outcomes:

At the end of the course the student should be

1. Able to develop creative, practical and sustainable solutions for planning and managing of building services systems.
2. Able to Plan a residential building from the point of view of grouping, circulation, lighting, ventilation and fire protection.
3. Knowing how energy is supplied to and used in buildings and the impact of energy efficiency on the design of sustainable buildings.
4. Able to plan and design a Green building.

UNIT-I: Planning of building: Relevant building bylaws, site selection for buildings, common errors in planning. Principles to be considered in judging plans, circulation diagrams. proportions for common areas like corridors, stairs, toilets etc. Study and design of small units.Data collection relating to different buildings.

UNIT-II: Acoustics of buildings: Reverberation - Determination of absorption coefficient- acoustic intensity- acoustic measurements. Factors affecting the acoustics of buildings- Sound distribution in an auditorium - Sound absorbent materials - Requisites for good acoustics.

UNIT-III: Green Buildings: Introduction – Necessity – Concept of Green Building- Principles of green building - Selection of site and Orientation of the building – usage of low energy materials - effective water conservation systems – Certification systems- GRIHA and LEED – case studies.

UNIT-IV: Building services:Fire protection - its importance, development of fire, reduced spread of fire, fire resistance in structural elements, means of escape.

Lifts and Escalators

Communication Services (Telephone and intercom facilities)

UNIT-V: Mechanical and Electrical Plumbing (MEP) - Plumbing fixtures- pipes and fittings – traps – one pipe systems and two pipe systems - reading single line diagrams.

Heating, Ventilation and Air conditioning (HVAC):

Ventilation in buildings- General principles of ventilation (Natural and artificial).Properties of air, air movements, temperature, humidity and quality of air. Design considerations for comfort.

Text Books:

1. S.P.Arora and S.P. Bindra, "*A Text book on building construction"*, DhanpatRai& Sons, 1993
2. V.S. Shahane. "Planning and Designing Building" , Poona, Allies Book Stall, 3rd Edn.
3. Michael Bauer, Peter Mosle and Michael Schwarz (2010) "Green Building – Guidebook for Sustainable Architecture" Springer.
4. Tom Woolley, SammKimmins, Paul Harrison and Rob Harrison (2001) "Green Building Handbook" Volume I, Spon Press.
5. MiliMajumdar, "Energy-efficient buildings in India" Tata Energy Research Institute. (2002)
6. TERI "Sustainable Building Design Manual – Volume I & II" Tata Energy Research Institute.

Suggested Reading:

1.Ben Stein "Building Technology: Mechanical and Electrical Systems", Wiley publishers John Wiley & Sons, 18-Feb-1997
2. Fred Hall and Roger Greeno, Building services hand book 5th edition.
3. Time Saver Standards.
4. National Building Code (NBC)

CE 315 TRANSPORTATION ENGINEERING

Instructions per week	:4 Periods
Duration of University Examination	:3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	:3

Course Objectives:

Toenable the student

1. Understand the design concepts of the highways, the quality of the materials required for the construction of highways and different techniques used in construction of flexible and rigid pavements.
2. Know how to collect the field data for the evaluation of traffic patterns.
3. Know the requirements for designing the railway tracks and the material required for the construction of permanent way.
4. Get an idea for the planning of airports and fixing of run way orientation and also applying the various corrections.

Course Outcomes:

At the end of the course, the student

1. Applies the Pavement design concepts to different types of pavement and analyze the collected field data and carries out the process for design of traffic management techniques.
2. Takesprecautions required for the execution of construction of pavements and applies relevant IRC standards.
3. Is able to apply the design concepts of super elevation of railway curves.
4. Knows how to select a site for airport construction and also knows howto fix the run way orientation and the circumstances in which the corrections to the run way length are to be applied**.**

UNIT-I: Highway alignment and geometric design: History of highway engineering, factors tobe considered for highway alignment, engineering surveys, obligatory points. Geometric design - Highways classification as per IRC and its standard dimensions, carriageway, shoulders, medians, right of way, footpaths, cycle tracks, service roads, frontage roads, sight distance, stopping sight distance, overtaking sight distance. Camber, horizontal curves, super-elevation, transition curve, extra widening, gradient, grade compensation and design of vertical curves.

UNIT- II: Traffic engineering: Objectives of traffic studies, traffic characteristics, volume, speed,density, headways and relationship among them. Traffic volume studies, speed and delay studies, intersection delay studies, highway capacity and level of service concept as per HCM 2000, origin and destination studies, intersection improvement studies at grade, need of grade separated intersections, channelization, rotary planning and design, concept of signal design, parking and accident studies.

UNIT-III: Highway materials & Pavement design: Various properties of highway materials,pavement types, factors to be considered for pavement design, structural difference between flexible and rigid pavement design. Flexible pavement design - concept of layer theory, design wheel load, ESWL, EALF, vehicle damage factor, design by CBR developed by US corps of engineers, IRC cumulative standard axles method (IRC - 37: 2013). Rigid pavement design - concept, wheel load stresses analysis by Westergaard. Sub-grade, dry lean concrete, radius of relative stiffness. Modulus of sub grade reaction and other characteristics of concrete, critical wheel load and temperature stresses. Longitudinal and transverse joints, contraction joints, expansion joints, construction joints, dowel bars and tie bars functions.

UNIT-IV: Railway Engineering: Introduction to Railways, permanent way component parts and itsfunctions. Rails - various types, functions, creep in rails, creep measurement, coning of wheels and rail fixations. Sleepers - various types. merits and demerits, ballast, various types and sub grade preparation. Railway alignment and geometric design - alignment.super-elevation, negative super elevation, cant deficiency. Example problems. Points and crossing. Layout of left and right hand turnouts. Construction and maintenance of permanent way.

UNIT –V: Airport engineering: Introduction to air transportation, history and internationalorganizations role in development of airports, air craft types and its characteristics. General lay-out of an airport and its component parts. Site selection of an airport as per ICAO, orientation of runway by wind rose diagrams, basic runway length determination, corrections to basic runway length, geometric design, types of airports as per landing & take-off and dimensions.

Text Books:

1. Khanna. S. K. and Justo, C. E. G (1994), "Highway Engineering", Nemchand& Bros, New Delhi. India.
2. Khanna. S. K. Arora, M. G. and Jain. S. S. (1994) "Airport Planning and Design" Fifth edition. Nem Chand & Bros, Roorkee, India.
3. Chandra, S and Agarwal, M. M. (2007) "Railway Engineering" Oxford Higher Education, University Press New Delhi.

Suggested Reading:

1. McShane, W.R., Roess, R.P. and Prassas, E.S., Traffic Engineering. Prentice Hall. Englewood Cliffs, 1997.
2. Yang, H. and Huang., “Pavement Analysis and Design”, Prentice Hall India Ltd-2004.
3. “Highway Capacity Manual”, Transportation Research Board, National Research Council. Washington, D.C., 2000.
4. Saxena. S.C and Arora. S, “Text book of railway Engineering” DhanpatRai and Sons. 1988.
5. Relevant IRC codes.

CE 316 WATER AND WASTE WATER ENGINEERING

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 3

Course Objectives:

To enable the student

1. Know how to estimate population for the forthcoming decades and estimate head loss in water distribution pipe networks
2. Know the design aspects of sedimentation tanks, clariflocculators and sand filters
3. Estimate storm water and sewage quantity and hydraulic design of sewers and to understand the design aspects of waste water treatment units in a sewage treatment plant
4. Study the different sludge disposal methods available and to know about the solid waste management in India and its drawbacks

Course Outcomes:

At the end of the course, the student should have learnt

1. To design the treatment units based on the population estimation
2. To apply the various design aspects of the treatment units
3. To apply the concepts of BOD, COD and TOC in sewerage systems and design of sewers anddesign the various treatment units in waste water treatment plant.
4. About solid waste management in India and low cost treatment technologies

UNIT-I

Introduction: Necessity of protected water supply and sanitation. Water demand and per capita consumption, factors affecting population forecasts.

Water supply: Sources of water and quality parameters, standards of potable water, infiltration pipes & galleries, intake structures pipes, joints, valves & pumps. Water distribution systems and solution of a simple network using hardy cross method.

UNIT-II

Treatment of water: Clarification sedimentation - Principles. Design of sedimentation tanks, coagu1ation and flocculation, design of a clari-flocculator. Filtration - Types of filters and filter media. Design principles of slow and rapid sand filters. Backwash mechanisms. Pressure filters. Disinfections - Necessity and methods, Chlorination of water supplied, action of chlorine, break point chlorination. Ozone and U-V radiations, Removal of hardness, tastes &odour control.

UNIT - III

Domestic sewage: Quantity estimation, quality parameters - BOD, COD and TOC. Sewerage systems, ultimate disposal of sewage.Land and water bodies.Sewage conveyance - Sewer types

and appurtenances.Velocity in sewers, Design of a simple sewerage system. Storm water sewers - Storm water estimation by rational method.

UNIT-IV

Waste water treatment: Preliminary treatment, screens, grit chambers. Primary treatment - Sedimentation - rectangular and circular sedimentation tanks.Secondary treatment - sewage filtration - trickling design. Activated sludge process - design parameters, secondary clarifier. Design aspects of a sewage treatment facility.

UNIT – V

Sludge: Sludge digestion and disposal methods - septic tanks- design parameters and working principles. Low cost waste treatment - oxidation ponds, RBC.

Solid waste: - Types, source and composition of solid waste. Methods of collection, transportation and disposal.

Text Books:

1. G.S. Birdi, Water Supply and Sanitary Engineering, DhanpatRai& Sons; 2002.
2. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi, 1994.
3. Metcalf & Eddy, M.C. "Wastewater Engineering – Treatment & Reuse", Tata McGraw Hill Publications, New Delhi, 2003

Suggested Reading:

1. Peavy H.S, Rowe D.R and Tchobanoglous G, ""Environmental Engineering " Tata McGraw Hill Publications, New Delhi, 1985
2. G.M. Fair, J.C. Geyer and D. Okun, "Water and waste Engineering", vol. II, John Wiley & sons, Inc., New York. 1968.

CE 444 HUMAN VALUES AND PROFESSIONAL ETHICS

Instructions	: 21 Periods per semester (7*3)
Duration of University Examination	: 2 Hours
University Examination	: 50 Marks
Sessional	: Nil
Credits	: Nil

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-1 Concepts and Classification of Values –Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – 2: Personal Development and Values in Life

Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character

Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

UNIT – 3: Practicing Values for the development of Society

Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society

Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integrity-Institutional Development.

UNIT – 4: Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories.

Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-5:Ethics in engineering profession

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management

Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., " Professional Ethics " , Oxford University Press , 2013
2. Nagarajan R.S., " A Text Book on Human Values and Professional Ethics " New Age Publications , 2007
3. Dinesh Babu S., " Professional Ethics and Human Values " , Laxmi Publications , 2007

Suggested Reading:

4. SantoshAjmera and Nanda Kishore Reddy " Ethics , Integrity and Aptitude " ,McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S." Professional Ethics and Human Values " Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In "Value Education & Spirituality " Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

CE 317 HYDRAULICS AND HYDRULIC MACHINERY LAB

Instructions per week	: 3 Periods
Duration of University Examination	: 3 Hours
University Examination	: 50 Marks
Sessional	: 25 Marks
Credits	: 2

Course Objectives:

To enable the student

1. Understand uniform and non-uniform flows and the importance of Froude number in open channel flows.
2. Determinesuper elevation in a curved channel.
3. Determine the force exerted by fluid jet on vane, determine efficiency and performance of turbinesand centrifugal pumps.
4. Study streamline patterns in a fluid flow system and air pressure distribution around an airfoil.

Course Outcomes:

At the end of the course, the student should have learnt

1. To compute the open channel Rugosity coefficient in uniform flows and Froude number and energy losses in non- uniform flows.
2. To differentiate between uniform, non-uniform flows and flow in curved channel
3. To determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps.
4. To find the discharge between stream lines and pressure variations around an airfoil.

List of experiments

1. Open Channel flow.	Determination of Manning's Rugosity coefficient
2. Open Channel Bend.	Determination of super elevation
3. Hydraulic Jump.	Determination of Froude number, Loss of energy
4. Impact of Jets.	Determination of force on vanes
5. Centrifugal Pump.	Determination of efficiency and performance characteristics of a pump
6. Pelton Wheel turbine.	Determination of efficiency and performance characteristics of a pelton wheel turbine
7. Franics Turbine.	Determination of efficiency and performance characteristics of a Francis turbine
8. Kaplan Turbine.	Determination of efficiency and performance characteristics of a Kaplan turbine
9. Hele Shaw's Apparatus.	Study of stream line pattern

CE 318 TRANSPORTATION ENGINEERING LABORATORY

Instructions per week	: 3 Periods
Duration of University Examination	: 3 Hours
University Examination	: 50 Marks
Sessional	: 25 Marks
Credits	: 2

Course Objectives :To enable the student

1. Assess the quality of the material used in pavement construction and compare with IRC specifications.
2. Identify the field data required for assessing the traffic parameters.

Course Outcomes At the end of the course, student should have learnt

1. Toapply methods for assessing various types of material to be used in the pavement construction.
2. To plan for the collection of field data and to present the same data for the analysis and take decisions for smooth movement of the traffic

A) Tests on bitumen

1. Penetration Test
2. Ductility test
3. Softening point test
4. Specific gravity test
5. Viscosity test
6. Flash and fire point test

B) Tests on road aggregates

7. Aggregate crushing value test
8. Los Angeles abrasion test
9. Aggregate impact value test
10. Aggregate shape test(flakiness & elongation)
11. Water Absorption
12. Soundness

C) Traffic Studies

13. Traffic volume study
14. Spot Speed Study
15. O & D Study concepts
16. Speed and delay studies

D) Miscellaneous Tests (demonstration only)

17. Determination of C.B.R.
18. Preparation of representative sample by coning and quartering.
19. Bitumen extraction test
20. Marshal stability concepts and Tests.

EG 221 SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT

Instructions per week	: 2 Periods
Duration of University Examination	: 3 Hours
University Examination	: 50 Marks
Sessional	: 25 Marks
Credits	: 1

Course Objectives:

To help the students

1. Participate in group discussions with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.

Course Outcomes:

The students will be able to

1. Be effective communicators and participate in group discussions with confidence. Also be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to mange time effectively and deal with stress.
4. Make the transition smoothly from campus to corporate. Also use media with etiquette and know what academic ethics are.

Exercise 1 Communicative Competence – The Art of Communication, basic grammar, Indianisms, Effective listening skills, using English in different situations

Exercise 2 Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence Elements of effective presentation – Structure of presentation – Presentation tools – Body language Creating an effective PPT

Exercise 3 Interview Skills – Resume‟ writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 4 Personality Development – Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.

Exercise 5 Corporate Culture – Grooming and etiquette, communication media etiquette Academic ethics and integrity

Suggested Reading:

1. Madhavi Apte , “A Course in English communication”, Prentice-Hall of India, 2007
2. Leena Sen , “Communication Skills”, Prentice-Hall of India, 2005
3. Dr. Shalini Verma, “Body Language- Your Success Mantra”, S Chand, 2006
4. Edgar Thorpe and Showick Thorpe, “Objective English”, 2nd edition, Pearson Education, 2007
5. Ramesh, Gopal swamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010
6. Gulati and Sarvesh, “Corporate Soft Skills”, New Delhi: Rupa and Co. , 2006
7. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004
8. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989

With Effect from the Academic year 2015-2016

SCHEME OF INSTRUCTION & EXAMINATION

B.E. III -YEAR
CIVIL ENGINEERING

II - SEMESTER
L=Lecture , T=Tutorial, D/P= Drawing/Practical

S. No	Syllabus Ref.No	SUBJECT	Scheme of Instruction			Scheme of Examination			Credits
			Periods per Week			Duration in Hrs	Maximum Marks		
			L	T	D/P		University Exam	Sessionals	
		THEORY							
1	CE 321	Soil Mechanics	4	0	0	3	75	25	3
2	CE 322	Design of Steel Structures-I	4	2	0	3	75	25	4
3	CE 323	Theory of Structures-II	4	2	0	3	75	25	4
4	CE 324	Reinforced Concrete Design-II	4	2	0	3	75	25	4
5	CE 325	Water Resources Engineering-I	4	0	0	3	75	25	3
6		Elective - I	4	0	0	3	75	25	3
		Theory Total	24	6	0	----	450	150	21
		PRACTICALS							
1	CE 326	Computer Applications Lab-I	0	0	3	3	50	25	2
2	CE 327	Soil Mechanics Laboratory	0	0	3	3	50	25	2
3	CE 328	Environmental Engg Laboratory	0	0	3	3	50	25	2
4	CE 329	Industrial Visit	0	0	0	0	0	Gr*	2*
		Practicals Total	0	0	9	-----	150	75	8
Grand Total (Theory +Tutorials +Practicals)			24	6	9	----	600	225	29

***Excellent/Very Good/Good/Satisfactory/Unsatisfactory (E/VG/G/S/US)**

Elective - I

CE 351 Advanced Transportation Engineering
CE 352 Geographical Information Systems
CE 353 Advanced Environmental Engineering
CE 354 Pre-Stressed Concrete
CE 355 Infrastructure Engineering
CE 356 Ground Water Hydrology

CE 321

SOIL MECHANICS

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 3

Course Objectives:

To enable the students

1. Understand the basic principles of soil mechanics, basic properties of soils and attain basic knowledge of identifying soil.
2. Understand the flow through soils and its behavior and gain a practical out look of utilizing soil as a construction material.
3. Capable of estimating the strength of soil to different loading conditions
4. Deal with problem of earth pressures and slope stability and to utilize the knowledge with respect to practical orientation and R&D perspective.

Course Outcomes:

At the end of the course, the student should

1. Be able to identify various types of soils, their properties and to apply the basic principles of soil mechanics to simple field problems.
2. Be able to prepare models for the behavior of soils, flow through soils and use/suggest soil as a construction material.
3. Be able o estimate the strength of soil under different loading conditions.
4. Be able to deal with the field problems of earth pressures and slope stabilities.

UNIT-1: Origin & Classification of Soils – Soil as a pseudo-elastic three phase particulate medium.

Physical properties of soils: Weight ratios (Water content, Density, Unit weights, Specific Gravity); Volume ratios (void ratio, porosity, degree of saturation, relative density); Inter-relationships. Laboratory testsfor determination of Index properties.Classification and identification of soils for general and engineering purposes as per IS: 1498-1970, Field identification of soils.

UNIT-II: Soil moisture states:

Capillarity in soils: Surface tension and capillary rise in soil, Capillary tension, Capillary pressure, PF Value.

Permeability of soils: Darcy's. law of seepage water through soils- validity of determination of co-efficient of permeability (constant head, variable head permeability tests) – Field tests (Pumping in and pumping out tests) – Equivalent permeability of stratified soils.

Seepage in Soil: Seepage flow, seepage pressure – Flow nets – Locating phreatic line in a homogeneous earthen dam using Kogeny's parabola – computation of seepage quantity.

Stress in Soils: Total effective and neutral stress.

Quick Sand Phenomena: Critical Hydraulic gradient, Remedial measures.

UNIT-III: Compaction Process: Compaction Mechanism, factors affecting compaction. Laboratory determination of compaction characteristics- standard and modified Proctor tests – IS Light and Heavy compaction tests; Field surface compaction : compaction equipment, procedure, quality control.

Consolidation Process: Spring analogy – Void ratio and effective stress (e VslogP) relationship – Terazaghi's theory of one dimensional consolidation - assumptions derivation of GDE – Computation of magnitude of settlement and time rate of settlement.

UNIT-IV: Shear strength: Significance of Shear strength in soils – Mohr-Coulomb equation – shear parameters – Laboratory tests for determination of shear strength – Direct shear test, Triaxial compression tests. (UU, CU and CD), Un-confined compression test Vane shear test. Factors affecting shear strength of cohesion-less and cohesive soils.Determination of elastic Modulii.

UNIT-V: Earth pressure: States of earth pressure – Active, Passive at rest condition; Rankine's theory; computation of active and passive earth pressure in c-less and c-O soils; Coulomb's Wedge theory; Rehbhan's graphical solution; stability of earth retaining gravity wall.

Slope stability: Definition and classification of slopes – types of slope failures-Factors of safety with respect to cohesion, angle of shearing resistance, Height – Analysis of stability of slope using Swedish slip circle method and Taylor's stability number.

Text Books:

1. Dr. B.C.Punmia, Er. Ashok Kumar Jain, Dr. Arun Kumar Jain "Soil Mechanicsand Foundations" , Edition: Sixteenth, 2005,Laxmi Publications
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors revised and enlarged sixth edition, 2007.
3. GopalRanjan and AS Rao, Basic and Applied Soil Mechanics, Wiley. Eastern Limited, 1996.
4. Braja M. Das and KhaledSobhan,"Principles of Geotechnical Engineering"
5. C.Venkatramaiah, "Geotechnical Engineering" New Age Publications, revised third edition, 2006

Suggested Reading:

1. Relevant IS Codes.
2. Scott, R.F., "Principles of Soil Mechanics", Addison Wesley, Massauchusetts.
3. Lambe, T.W. and Whitman, R.V., "Soil mechanics", John Willey & Sons Inc. NY, 1969.

CE 322

DESIGNOF STEEL STRUCTURES -I

Instructions per week	: 4 (Th) + 2 (T)
Duration of University Examination	:3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 4

Course Objectives:

To enable the students

1. learn and apply the design philosophies(working stress method and limit state method) for various steel structural components and their connections, as per the relevant standards
2. apply the design principles of Steel Structures to field problems
3. Draw, understand and interpret the detailing aspects of Steel Structures.
4. Develop interest in pursuing higher education/research in the field of Steel Structures.

Course Outcomes:

At the end of the course, the student

1. Attains fundamental knowledge of the design of various Steel Structures and connections and is able to interpret the specifications of relevant codes.
2. Gets adequateknowledge and skills to apply the design principles to field problems.
3. is able to draw , understand and interpret the detailing aspects of steel structural drawings .
4. is able to investigate into the critical issues of steel structures,compare various options and chose the best solution for the problems in the area of steel structures.

UNIT – I: Materials and Specifications: Chemical composition of steel, types of Structural Steel - classification of Rolled Steel Sections.

Design Philosophies: Working Stress Method, Limit State Method,

Loads and Load Combinations: Design Loads & load Combinations; Characteristic Loads, Partial safety factors for materials and loads.

Bolted Connections (Limit State Method): Lap & Butt joints & theirbehavior of Bolted Joints - Modes of failure - Design of Bolted joints using ordinary Black Bolts - Concentric Connections and Eccentric Connections - High Strength Friction Grip Bolts.

Welded Connections (Limit State Method): Lap and Butt Joints- strength of welded joints - design of welded joints - Concentric Connections and Eccentric Connections.

UNIT – II: Design of Compression Members (Limit State Method): Introduction, Buckling & yielding phenomena, Sections used for compression Members. Effective Length of Compression Members, Design of Compression Members with single section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices.

Design of Column Bases: Design of Slab and Gusset Bases.

UNIT – III: Design of tension members (Limit State Method): Introduction to tension members - Applications of tension members, Modes of Failure, Design of Tension Members – Design of Lug Angles - Staggered bolting

Working Stress Method (as per IS 800-2007): Permissible Stresses, Slenderness Ratio, Design of tension members, Design of Simple Compression Members

UNIT – IV: Design of Beams (Limit State Method) : Introduction to Plastic Analysis - Plastic Hinge, Plastic moment, Shape factor; Classification of Cross Sections, Phenomenon of Lateral Torsional Buckling; Design of Laterally Supported beams and laterally Unsupported Beams, Secondary considerations - Check for Web crippling, web buckling & deflection Web Buckling and Web Crippling

UNIT – V: Design of Roof trusses (Limit State Method): Types of trusses, Estimation of loads- dead load, live load and wind load, Design of purlins, Analysis of roof trusses and design of its members with angle sections.

Text Books:

1. Subramanian. N, "Design of Steel Structures", Oxford University Press, 2008.
2. S.K.Duggal, "Design of Steel Structures", 2nd Edition, Tata McGraw Hill Publishing, 2014

Suggested Reading:

1. Bhavikatti, S.S., "Design of steel Structures", 3rd Edition, I.K. International Publishing House Pvt. Ltd. 2012.
2. IS 800 :2007

CE 323 THEORY OF STRUCTURES-II

Instructions per week	: 4 (Th) + 2 (T)
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 4

Course Objectives:

To enable the student

1. Use ILD's and to draw influence line diagrams for determinate beams and truss girders.
2. Learn the concepts of moving loads and their effect on structures,analysis of cables and suspension bridges.
3. Apply the basic concepts of matrix methods in structural analysis.
4. Develop stiffness and flexibility matrices and analyze the structures.

Course Outcomes:

At the end of the course, the student is

1. Able to draw the ILD's and find the maximum forces and position of the moving loads to get maximum values.
2. Able to understand the concept of moving loads , and analyse the cables and suspension bridges.
3. Able to apply appropriate matrix method for analysis of beams, frames and trusses.
4. Able to develop stiffness and flexibility matrices for various structures.

UNIT-I :Moving loads: Influence line for reaction, bending moment and shear force at any location for a simple beam. Determination of maximum support reactions, Maximum bending moment and shear force at any location for moving load systems on simply supported girders.

Curves of maximum bending moment and shear force for simply supported girders traversed by (i) single point load, (ii) two point loads, (iii) uniformly distributed load longer than span, and (iv) uniformly distributed load shorter than span, enveloping parabola and EUDLL.

Influence lines for horizontal thrust, bending moment, normal thrust and radial shear in three hinged arches.

UNIT – II: Moving loads on trusses/girders: Influence lines for forces in members of statically determinate plane framed structures under moving loads for warren girder, Pratt truss, and curved flange truss.

Suspension bridges: Stresses in suspended loaded cables, length of cable, simple suspension bridge with 3-hinged stiffening girders for static loading. Influence lines for support reactions, tension in the cable, bending and shear force.

UNIT –III :Flexibility method of Analysis: Analysis of continuous beams, pin jointed plane trusses and rigid jointed plane frames with static indeterminacy not exceeding two.

UNIT – IV: Stiffness method of Analysis: Analysisof continuous beams, pin jointed plane trusses and rigid jointed plane frames with kinematic indeterminacy not exceeding three. Direct formulation of stiffness matrix for plane frames with number of bays and stories not exceeding two.

UNIT – V: Direct Element method: Development of element stiffness matrices for bar, truss, beam and plane frame elements, transformation matrices, equivalent joint loads, boundary conditions, assembly of global stiffness and load matrices for axially loaded bars, continuous beams, plane trusses, and plane frames.

Text Books:

1. Ramamrutham, S., "Theory of Structures, DhanpathiRai Publishing Co.(P) Ltd, 2014
2. Weaver and Gere, "Matrix Analysis of Framed Structures", CBS Publisher, 2004
3. D.S. PrakashRao, Structural Analysis – a Unified Approach, University Press, 1996.
4. Gupta, S. P and Pandit, G.S. Structural analysis A Matrix approach, Tata McGraw Hill

Suggested Reading:

1. T.S.Thandavamoorthy, "Structural Analysis":,Oxford Higher Education, Second Impression, 2012.
2. B.C. Punmia, Ashok Jain and Arun K. Jain, "Theory of Structures", Laxmi , Publication, 2000.
3. S.B. Junarkar and Shah, "Mechanics of structures", Charotar Pub. House, 2001.
4. R. C. Hibbeler, "Structural Analysis", 8/E, Prentice Hall, Higher Education, 2012.

CE 324 REINFORCED CONCRETE DESIGN- II

Instructions per week	:4(Th) + 2 (T)
Duration of University Examination	:3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	:4

Course Objectives:

To enable the student

1. Understand and applythe fundamentals of design principles for various advanced RC elements such as combined footings, retaining walls, water tanks and bridges
2. Attain the Capability of detailingthe various advanced RC elements such as combined footings, retaining walls, water tanks and bridges.
3. Compare the designs for a given advanced RC element and arrive at a better solution.

Course Outcomes:

The students will be able to

1. Design the advanced RC elements such as Combined footings, Retaining walls, Water tanks and Bridges (Solid Slab / T-Beam).
2. Demonstrate the ability of preparing and interpreting structural drawings and detailing aspects for these advanced RC structural elements.
3. Compare the designs for a given advanced RC element (Combined Footing/Retaining Wall/Water Tank/Bridges) and arrives at a better solution.

(Note: All relevant IS codes necessary for teaching this course may be introduced and referred in detail by the Faculty concerned)

UNIT – I:Combined Footings: Limit state design & detailing of combined rectangular and trapezoidal footings - Limit state design of raft foundations for column grids up to (2 x 2) 4 columns.

UNIT – II:Retaining walls: Types - components- proportioning the dimensions- stability analysis- Limit state design & detailing of Cantilever and Counterfort type retaining walls subjected to different earth pressure conditions.

UNIT – III: Water tanks: Elastic Design & Detailing for RCC circular and rectangular ground level and over-head tanks- Design of staging. Design& Detailing of Intze tanks.

UNIT – IV: Bridges: Basic components- Types of bridges -Loads on bridges- IRC standards ; Elastic design and detailing of two lane, simply supported RC Solid Slab bridge- Design of Kerb

UNIT- V: T-beam bridges: Components of a T-beam bridge- Elastic design and detailing of two lane, Simply Supported, Three girder R C T-beam bridge- Use of effective width method- Pigeaud's curves and Courbon's method.

Text Books:

1. N. Krishna Raju, “Advanced Reinforced Concrete Design", Universities Press, 1992.
2. Vazirani and Ratwani," Design Of Concrete Bridges",Khanna Publishers, 1998.
3. Krishna Raju.N, "Design of Bridges", Oxford and IBH Publishing, Fourth Edition

Suggested Reading:

1. D.S. PrakashRao; Design Principles and Detailing of Concrete Structures, Tata McGraw-Hill Publishing Co. Ltd., 1995.
2. Johnson Victor, D., “Essentials of Bridge Engineering”, Oxford & IBH Publishing Co., New Delhi, Fourth Edition, 1991
3. Ponnuswamy, S., “ Bridge Engineering”, Tata McGraw Hill, New Delhi 1986.

CE 325 WATER RESOURCES ENGINEERING-I

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 3

Course Objectives

To enable the student

1. Getcomprehensive knowledge about occurrence, quantification of surface & Ground water and understand water conservation, water sharing, and water laws, crop water requirements, micro irrigation, irrigation canals, lift irrigation and layouts
2. Apply knowledge of diversion head works and design a weir/barrage, assess and resolve weir failures, understand the importance of Canal regulators and apply the knowledge to field problems.
3. Attainan ability to apply knowledge in water resource projects planning formulation, estimation, execution,control and managing the projects.
4. Get an ability to understand river basin planning and interlinking of rivers

Course Outcomes

At the end of the course, the student should havegot

1. The Skill of functioning & planning of an Irrigation system including canals, ability to understand water harvesting, water sharing and water laws to assess surface and ground water availability
2. The skills on lift irrigation and develops capability to run a large irrigated command as an Irrigation manager
3. The skills to plan, execute and managing water resources projects and gains exposure on contemporary issues
4. The ability to design canal, diversion head works, and regulators.

UNIT – I: Hydrology : Scope of hydrology in civil engineering, hydrologic cycle, rainfall, measurement of rainfall and estimation of mean rainfall over a catchment,optimumnumber of rain gauges for a catchment,infiltration, evaporation, runoff, factors affecting runoff, peak flow estimation, unit hydrograph method, flood frequency and return period. HydrologicInformation System, Water law and principles of Water Sharing,

UNIT - II : Irrigation: Duty, delta and base period of crops,water requirement of crops, methods of irrigation, micro-irrigation, irrigation efficiencies, depth of irrigation, wilting point, consumptive use, types of canals,alignment of canals, canal sections, balancing depth of cutting, Kennedy's and Lacey's theories, design of lined and unlined canals.

Necessity of a Lift Irrigation scheme, Lay-out & component parts.

UNIT – III: Diversion head works: Components, causes of failures, difference between weir and barrage, Bligh's creep theory, Khosla's theory and method of independent variables, design principles of barrage.

UNIT – IV: Regulation works : Canal falls, types, design principles of trapezoidal notch fall, types of regulators, functions of cross regulator and head regulator, Cross drainage works, types, selection and design principles, types of outlets, flexibility, sensitivity and proportionality of outlets.

UNIT – V: Water resources development and management: Types of water resources development projects, functional requirements of multipurpose projects, project formulation, project evaluation, management strategies, water management problems, systematic canal operation, Warabandhi system, farmers' participation in water management, Integrated River Basin Planning& Management. Interlinking of Indian Rivers.
Aquifers : Types aquifer parameters, steady radial flow into confined and unconfined aquifers, yield of an open well, Water harvesting structures and augmentation of Ground water

Text Books:

1. Water Resources engineering, Vol1 & 2, By S.K.Garg
2. Irrigation &Water Resources Engineering, B.C. Punmia
3. Murthy, V.S, Watershed Management–New Age International Publishers, New Delhi, 1998.
4. Subramanya.K, Engineering Hydrology, Third Edition, McGraw Hill Education Publishers 2008.

Suggested Reading:

1. Ghanshyam Das, Hydrology and soil Conservation Engineering, Prentice-Hall of India Pvt. Ltd, New Delhi, 2000.
2. Tideman E. M., Watershed Management, Omega Scientific Publishers, New Delhi, 1996.
3. G J Young, J C I Dooge and J C Rodda, Global Water Resources Isues, Cambridge University Press, Cambridge, UK, 1994.
4. Patra, K.C., Hydrology and water resources Engineering, 2nd edition, Narosa Publishing Company – 2008

CE 351 ADVANCED TRANSPORTATION ENGINEERING
(Elective-I)

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 3

Course objectives:

To enable the student

1. Understand the various materials and methods used for soil stabilization for roads.
2. Learn and apply the basic design principles for rigid and flexible pavements.
3. Evaluate the distress in highways, capacity of highways, transport cost and economy of a Highway..
4. Know the travel demand and management concepts and use computer applications for traffic and transport planning.

Course Outcomes:

At the end of the course, the student should be

1. Able to apply various materials and methods for soil stabilization of roads.
2. Able to design a Rigid and flexible pavement.
3. Able to evaluate the distress in highways, capacity of highways, transport cost and economy of a Highway.
4. Able to apply the travel demand management concepts and use computer applications for traffic and transport planning.

UNIT-I

Soil – Stabilized Road: Preliminary investigation, materials, Techniques of stabilizations,Methods of stabilization, Mechanical, Soil Cement, Soil Bitumen and Soil Lime Stabilization.

UNIT-II

Flexible and rigid pavement design: GI method, IRC revised CBR, Wyoming CBR, Designof rigid pavement ESWL, Stresses due to Loads, Temperature, Warping, Friction & Critical combination, IRC Method.

UNIT-III

Pavement distress and Evaluation: Skid resistance, structural evaluation, Benklemen beamsmethod, Overlays, Highway drainage – importance, requirements surface drainage system, sub-surface drainage system.

UNIT-IV

Highway capacity & Economic evaluation: Passenger car units (IRC), Level of service –

concept, factors, multilane capacities for rural, urban, and express ways.
Concept of – Transport cost & benefits: Benefit cost ratio, net present value, rate of return,and their relative comparison for evaluation. Accidents – causes, methodologies for accident costing precautions to minimize the accidents.

UNIT V
Travel demand management: Traffic Management Systems (TMS) – Restrictions on turningmovements, One way streets, tidal flow – Operations, Exclusive bus lanes.
Traffic Relief at junctions, at plane, parking studies, parking inventories, types of parking service, parking analysis, bottle necks..
Nature of traffic problems in cities.Effect on environment due to traffic noise and air pollution.Introduction of Computer applications in traffic and transport planning.

Text Books:
1. Kadiya, L.R., Traffic Engineering and Transportation Planning, Khanna Publications.
2. Sharma, S.K., Principles, Practice and Design of Highway Engineering
3. Gordon, Simulation and Modeling.
4. S.K. Khanna and C.E. Justo, Highway Engineering

Suggested Reading:
1. G.V.Rao,Principles of transportation and Highway Engg. By
2. SubhashC.Saxena ,Text book Highway and Traffic Engineering,

CE 352 GEOGRAPHICAL INFORMATION SYSTEMS

(Elective-I)

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 3

Course objectives:

To enable the student

1. Understand the basics and applications of GIS, and to take decisions using GIS under uncertain Conditions
2. Understand the various types of data, realize the importance of spatial data and apply methods of data compression
3. Perform data analysis and modelling using GIS.
4. Understand the basics of remote sensing and apply the principles to watershed modelling, environmental modelling and watershed management.

Course Outcomes:

At the end of the course, the student

1. Is able to apply the principles of GIS to various field problems and take decisions under uncertain conditions.
2. Is able to apply the methods of data Compression using GIS.
3. Can perform the data modelling and analysis using GIS.
4. Is able to apply the basic principles of Remote Sensing for Watershed modelling, Environmental Modelling and for Watershed Management.

UNIT I

Introduction: Map, definitions, representations – Point line, polygon, common coordinatesystems, map projects – transformations – Coordinate systems- – map analysis. History of development of GIS – Applications of GIS: Soil and water resources, agriculture, land use planning, geology and municipal applications, using GIS for decision making under uncertainty.

UNIT-II

Data entry, storage and maintenance: Data types – spatial non spatial (attribute data) – datastructure, data format – point line vector – Raster – Polygon – Object structural model – filters and files data in computer – keyboard entry, manual digitizing, scanner, remotely sensed data. Existing digital data – cartographic database,.Digital elevation data – data compression.

UNIT-III

Data analysis and modeling: Spatial analysis, data retrieval, query (SQL) – Simple analysis,recode overlay, vector analysis, raster data analysis – modeling in GIS – Digital elevation model

– cost and path analysis – knowledge based systems.

GIS Analysis Functions: Organizing data for analysis, classification of GIS analysis function,maintenance and analysis of spatial data – transformation, conflation, edge matching and editing, Maintenance and analysis for non-spatial attribute data editing and query functions.

UNIT-IV

GIS analysis function for integrated analysis of spatial and attribute data: Retrieval andclassification function: Overlay operations, neighborhood operations, connectivity function, output formatting – Map annotations text pattern and line styles, graphic symbols, cartographic modeling by GIS analysis procedure with an example.

Presentation of Geo-data Analysis: Types of output data – types of errors elimination andaccuracies – sampling - components of data quality.

UNIT-V

Introduction of Remote Sensing: Electromagnetic radiation, characteristics, interaction withearth surface, sensors types, satellite characteristics IRS series, data products interpretation of data.

Software scenario – Functions: Watershed modeling, Watershed Management, Environmentalmodeling – Visibility analysis.

Text Books:

1. Introduction to GIS BY Kang- Tsung Chang, Tata McGraw Hill Edition.
2. Burrough P.A., Principles of GIS for land resource assessment, Oxford publications.
3. Remote sensing and Image Interpretation by Lilys and john welly and sons.
4. Stan, Geographical Management Systems A management perspective.

Suggested Reading:

1. IAN Heywood, Sarah Cornelius and Steve Carves, An introduction to Geographical information system.
2. B.Bhatta , Remote Sensing and GIS.
3. Dr. S.Kumar, Basics of Remote Sensing and GIS

CE 353 ADVANCED ENVIRONMENTAL ENGINEERING

(Elective-I)

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	: 75 Marks
Sessional	: 25 Marks
Credits	: 3

Course objectives:

To enable the student

1. Understand the methods of Industrial waste water management and treatment.
2. Evaluate the ambient air quality, monitor it, and analyze it for knowing the pollutants.
3. Understand the methods of air pollution control
4. Understand the need and objectives of Environmental Impact Assessment(EIA), evaluate the impacts of road project, Industry and dam and plan for the Management of surrounding environment.

Course Outcomes:

At the end of the course, the student is able to

1. Apply the methods ofIndustrial waste water management and treatment.
2. Evaluate the ambient air quality, monitor it and analyse it for knowing the pollutants.
3. Apply the methods of air pollution control to field situations.
4. Evaluate the impact of road project, industry and a dam on the surrounding environment.

UNIT – I

Industrial waste Management: Types of industries, characteristics of Industrial wastes, effects of industrial effluents on streams, land and human health. Environmental legislation related to Industrial effluents and hazardous wastes. Self-purification of water bodies, Streeter Phelps Equation.

UNIT-II

Industrial Waste Water treatment: Manufacturing process, waste water characteristics and effluent treatment of the following industries- leather tanning, dairy, pulp and paper, pharmaceutical, textiles, steel plants, thermal power plants, fertilizer, cement, sugar and distilleries.

UNIT- III

Air pollution: Sources, classification and effects of air pollutants, Meteorology of air pollution, wind rose diagrams, lapse rates, atmospheric stability an dispersion of air pollutants, stck height calculation, ambient air quality monitoring, stack sampling, analysis of air pollutants.

UNIT- IV

Air Pollution Control: Air quality standards, methods of air pollution control – zoning, source correction, control of suspended particulate meter by equipment (gravitation, centrifugation,

flirtation, scrubbing, electrostatic precipitation), selection of proper equipment, gaseous pollutant control by adsorption, condensation, combustion.

UNIT-V

Environmental Impact Assessment: Need for environmental impact assessment (EIA), objectives of EIA, EIA capabilities and limitations. Legal provisions of EIA, Base line at a collection required for EIA, Evaluation of impacts, Prediction of impacts, Preparation of Environmental Management Plan, Preparation of EIAs of road project, Industry, and dam. Issues related to rehabilitation of affected people, Preparation of Environment, Impact statement and Environment Management Plan.

Text Books:

1. Rao M.N. and Dutta, Waste Water Treatment, Oxford and IBM Publications Ltd.
2. Eckenfelder, WW., Industrial Water Pollution Control. McGraw Hill Book Co.
3. M.N. Rao, H.V.N. Rao, Air Pollution Control, Tata McGrawHill

Suggested Reading:

1. C.S.Rao Environmental Pollution Control Engg., Wiley Eastern Ltd. New Delhi
2. Peavy and Rowe, Environmental Engg., McGrawhill Publications
3. Keiley, EnvironmetnalEngg., McGrawHill Publishers, 2003
4. Sincero and Sincere, Environmental Engg., Prentice Hall of India

CE 354 **PRE-STRESSED CONCRETE**

(Elective-I)

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 3

Course Objectives:

To enable the student to

1. Understand the basic concepts of Pre-stressing, to know the materials, permissible stresses& methods of Pre-Stressing.
2. Analyze and Design PSC Beams for flexure
3. Compute the deflections, cable profiles and to understand the basics of load balancing methods.
4. Understand the design of End blocks and Continuous beams.

Course Outcomes:

At the end of the course, the student is able to

1. Interpret the knowledge of materials,Stresses and Prestressing methods for simple field problems
2. Analyze and design simple PSC beams
3. Apply the load balancing methods to PSC beams
4. Design end blocks and continuous beams.

UNIT – I

Introduction: Basic concepts, materials, permissible stresses – systems of pre stressing. Losses of pre stress in pre-tensioned and post-tensioned members

UNIT – II

Design: Analysis and Design of PSC beams for flexure using elastic analysis of simple and composite sections.

UNIT – III

Design of sections for flexure: Design of R.C. section by Elastic theory for flexure.

Design for Shear: Shear and principles stresses, Design of R.C. section for shear, cracked and un cracked sections - codal provisions.

UNIT – IV

Deflections: Importance of deflections, factors influencing deflection, codal provisions, short terms and long-term deflections – computation Cable profiles, Kern points, limiting points - load balancing method problems on load balancing method.

UNIT – V

End blocks: Nature of stresses, stress distribution - MagnelandGauyon's Methods - codal provisions - Design by Guyon's method.

Continuous Beams: Advantages of continuous members - Cod provisions - Analysis of two span continuous beams - Concordant cable profiles.

Text Books:

1. N. Krishna Raju, *Prestressed Concrete,* Tata McGraw Hill, 2000.

Suggested Reading:

1. G .S. Pandjt and S.P. Gupta, *Prestressed Concrete,* CBS Publication, 1995.
2. Dayarathnam, *Prestressed Concrete,* Oxford & IBH Publication.

CE 355 **INFRASTRUCTURE ENGINEERING**

(Elective-I)

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 3

Course Objectives:

To enable the students

1. Understand the basics of urban and rural infrastructure concepts of SEZ and life cycle and salient features of infrastructure projects of various fields.
2. Understand the benefits, challenges and importance of publics & Private sector role in Infrastructure development.
3. Understand the concepts of Infrastructure planning evaluate the risks and learn the strategies for successful implementation of infrastructure projects.
4. Understand the environmental laws and regulations and evaluate the EIA of Infrastructure projects.

Course outcomes:

At the end of the course, the student is able to

1. Apply the basics of urban and Rural Infrastructures, concepts of SEZ and life cycle to field problems.
2. Interpret the role of public and private sectors properly and use them for infrastructure development
3. Evaluate the risks and plan strategies for successful implementation of infrastructures projects.
4. Interpret properly the environmental laws and regulations and evaluate the EIA of infrastructure Projects.

UNIT – I

An overview of Infrastructure Engineering: Urban Infrastructure and Rural Infrastructure in general. An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, the Stages in an Infrastructure Project, Concept of Lifecycle., etc., An Overview of Infrastructure Projects in Power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors and Telecommunications.

UNIT – II

Public & Private Sector Role in Infrastructure Development:A Historical Overview of infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization water supply, Power, Infrastructure, Road Transportation Infrastructure in India – Introduction to B-O-T, BOOT projects & PPP Projects. Case studies preferable.

UNIT – III

Infrastructure Planning and Implementation: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Core Economic and Demand Risks, Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure – Case studies preferable.

UNIT – IV

Environmental and Social Impact Assessment aspects: Categories, Attributes and Parameters, Identification of Environmental and Social Impacts over Project Area and over project Cycle. Special Considerations Involving Land and Water Interrelationship- Environmental Laws and Regulations.

UNIT – V

Strategies for successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of infrastructure Project. Governments Role in Infrastructure Implementation, An Integrated Framework for successful Infrastructure Planning and Management – Infrastructure Management Systems and Future Directions.

Text Books:

1. Grigg, Neil, Infrastructure Engineering and Management, Wiley, (1988).
2. Haas and Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994)
3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, MCGraw Hill, (1997).

Suggested Reading:

1. Munnell, Alicia, Editor, Is there a shortfall in Public Capital Investment? Proceedings of a Conference Held in Jun (1990).
2. World Development Report 1994: Infrastructure for Development (1994).
3. Zimmerman, K. and F.Botelho, "Pavement Management Trends in the United States" Ist European Pavement Management Systems Conference, Budapest, September (2000).
4. Anjaneyulu, Y &Manickam. V. (2012). Environmental Impact Assesment Methodology. B.S. Publications, Hyderabad.
5. NPTEL – Course Material prepared by IIT madras.

CE 356 **GROUND WATER HYDROLOGY**
(Elective-I)

Instructions per week	: 4 Periods
Duration of University Examination	: 3 Hours
University Examination	:75 Marks
Sessional	:25 Marks
Credits	: 3

Course Objectives:

To enable the student

1. Understand the Hydrologic cycle, types of aquifers, Concepts of permeability, transmissibility and ground water flow.
2. Understand the various types of flows into well.
3. Comprehend the various methods of Geophysical exploration.
4. Understand, interpret and implement the concepts of Ground water recharge and ground water management.

Course Outcomes:

At the end of the course, the student is able to

1. Interpret the concepts of permeability, transmissibility and ground water flow to field problems.
2. Evaluate the flow into a well
3. Apply various methods of geophysical explorations to field situations.
4. Interpret and implements the concepts of Ground water recharge and ground water Management.

UNIT-I

Introduction : Ground water and hydrologic cycle, vertical distribution of ground water, Types of aquifers, unconfined, confined and leaky aquifers, porosity, void ratio, storage coefficient, permeability, transmissibility, specific yield, safe yield, General equation of ground water flow, steady unidirectional flow, steady radial flow to a well in unconfined and confined aquifers. Steady flow with uniform recharge

UNIT-II

Unsteady Radial Flow to a Well: Non equilibrium equation for pumping tests, Thesis method of solution, Cooper Jacob method, Chow's methods of solution, law of times, well flow near aquifer boundaries, Image wells, multiple well systems, partially penetrating wells, steady radial flow in leaky artesian aquifer. Well completion and well development.

UNIT-III

Geophysical Exploration : Surface investigations, of ground water – Electrical Resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, Dowsing, Subsurface Investigations – Test drilling, resistivity logging, potential logging, Temperature logging, caliper logging, Interpretation of logs and selection of site as a well.

UNIT-IV

Artificial Recharge of Ground Water: Methods of recharge, water spreading, sewage discharge, Recharge through pits and shafts, Recharge through well, Induced recharge. Sea water intrusion in coastal aquifers; occurrence, Ghyben – Herzberg relation, shape of fresh – salt water interface, length of the intruded sea water wedge, oceanic island aquifers, upcoming, prevention and control of sea water intrusion.

UNIT – V

Ground Water Basin Management: Conjunctive use of surface and ground waters, Hydrologic balance equation. Ground water analog models – Sand models, electric analog models, viscous flow models, numerical analysis models – Finite difference methods.

Text Books:

1. D.K. Todd, Ground Water Hydrology, John Wiley & Sons, Inc., USA
2. H.M. Raghunath, Ground Water, Wiley Eastern Limited, New Delhi.

Suggested Reading:

1. K.P. Karnath, Ground Water Ananment, Development and Management, Tata McGraw Hill Publishing Company, New Delhi
2. Walton, Ground Evaluation and Management, Mc. Graw Hill
3. Bouwer, Ground Water Hydrology, Mc. Graw Hill

CE326 COMPUTER APPLICATIONS LAB-I

Instruction per week	: 3 Periods
Duration of University Examination	: 3 Hours
University Examination	: 50 Marks
Sessional	: 25 Marks
Credits	: 2

Course Objectives:

1. To prepare the students with good programming skills in the Civil Engineering Applications
2. To empower the students to develop tailor made programs using 'Excel / C programming'

Course Outcomes:

At the end of the course the student should have learnt

1. To write the programs for the problems listed.
2. The basics to write C-Programmes, use Excel sheets for Civil Engineering applications.

Excel Application & 'C'-programming.

1. Design of Singly Reinforced beam.
2. Shear Design of a beam.
3. Design of Axially loaded short Column.
4. Stability Analysis of Retaining Wall.
5. Pressure Bulb under a concentrated load.
6. Selection of diameter of a pipe for different types of flows through a circular pipe.
7. Design of circular sewer.
8. Run off calculations.
9. Introduction to STAAD-Pro. (up to Fixed /Continuous beams for various loadings)

CE 327

SOIL MECHANICS LABORATORY

Instruction per week	: 3 Periods
Duration of University Examination	: 3 Hours
University Examination	: 50 Marks
Sessional	: 25 Marks
Credits	: 2

Course Objectives:

1. To prepare the students with good skills in the laboratory procedures in soil mechanics
2. To empower the students to deal with the filed and laboratory procedures in soil Explorations and sampling procedures.

Course Outcomes:

At the end of the course the student should have learnt

1. The basic skills of conducting experiments on Soils for knowing their properties, identifying its type and interpret the results.
2. To apply the experimentation skills to the field problems such as site investigations and Soil Exploration techniques.

Determination of Basic and Index properties (Any Five Tests)

1. Determination of specific gravity of soil solids using "Density bottle" method.
2. Determination of specific gravity of soil solids using "Pycnometer" method.
3. Determination of water content using "Pycnometer" method.
4. Determination of liquid limit using Casgrande's standard LL device.
5. Determination of liquid limit using cone penetration apparatus.
6. Determination of plastic limit.
7. Sieve Analysis for plotting Particle size distribution curve.
8. Determination of Field Density using Sand Replacement Method.
9. Determination of Relative Density of Sand

Determination of Engineering properties (Any Five Tests)

10. Determination of Compaction Characteristics.
11. Determination of Co-efficient of Permeability by "Constant Head Permeameter test"
12. Determination of Co-efficient of Permeability by "Variable Head Permeametertest".
13. Determination of shear strength parameters by "Direct Shear Test"
14. Determination of shear strength of cohesive soils by "Unconfined compressionTest".
15. Determination of shear strength of conducting "Vane shear test"

Test Procedures:

16. Consolidometer test
17. Tri-axial shear test

Suggested Readings:

1. Relevant IS Codes of Practice.
2. Lambe, T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi, 1969.
3. Relevant ASTM Codes of Practice.

CE 328

ENVIRONMENTAL ENGINEERING LABORATORY

Instructions per week	:3 Periods
Duration of University Examination	:3 Hours
University Examination	:50 Marks
Sessional	:25 Marks
Credits	:2

Course Objectives:

To enable the students

1. Conduct common environmental experiments relating to water and wastewater quality.
2. Interpret laboratory results and report the values in comparison with environmental quality standards.
3. Apply the laboratory results for problem identification, quantification, and basic environmental design.

Course Outcomes:

At the end of the course, the student should have learnt

1. To establish water and wastewater quality, and know which tests are appropriate for given environmental problems.
2. ToStatistically analyze and interpret laboratory results.
3. To use the water and wastewater sampling procedures and sample preservations.
4. To Obtain the necessary background for subsequent courses in environmental engineering.

List of Experiments

1. Determination of alkalinity
2. Determination of hardness.
3. Determination of chlorides.
4. Determination of calcium.
5. Determination of variation of PH.
6. Determination of electrical conductivity and calculation of specific conductivity.
6. Determination of B.O.D.
7. Determination of total solids, total inorganic solids & total volatile solids.
8. Determination of residual chlorine.
9. Determination of turbidity.
10. Determination of optimum coagulant dosage by jar test.
11. Determination of C.O.D.
12. Determination of Sodium & Potassium present in water using flame photometer.
13. Determination of break point chlorination

Suggested readings:APHA, Standard Methods for the Examination of Water and Wastewater, 21st Ed. Washington, 2005

CE 329

INDUSTRIAL - VISIT/STUDY

At least 3 days in Semester **4 x 6 = 24 hours**
Sessional / Examination **Grade***

Students are expected to visit at least two works of Civil Engineering importance in and around Hyderabad and submit a detail report on the same to the department. . The Department should evaluate the reports and presentationthrough a Committee consisting of Head of the Department and two more members of the senior faculty.

***Excellent / Very Good / Good / Satisfactory / Unsatisfactory.**