COURSE HANDOUT : S8 CE

RAJAGIRI SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

❖ VISION

The department strives to excel in the areas of academia, research and industry by moulding professionals in the field of Civil Engineering to build a sustainable world.

❖ MISSION

To impart quality education and mould technically sound, ethically responsible professionals in the field of Civil Engineering with a broad skill set of creativity, critical thinking and effective communication skills to meet the desired needs of the society within realistic socio-economic environmental constraints.

➢ PROGRAMME OBJECTIVES

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of natural sciences, and engineering sciences.mathematics,
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. . The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

INDEX

ASSIGNMENT SCHEDULE

DATE	SUB. CODE	SUBJECT
15.02.17	CE010 801	Advanced Structural Design
20.02.17	CE010 802	Building Technology and Management
23.02.17	CE010 803	Environmental Engineering – 2
27.02.17	CE010 804L02	Environmental Geotechniques
27.02.17	CE010 804L04	Highway and Airfield Pavements
02.03.17	CE010 805G05	Numerical Methods
02.03.17	CE010 805G06	Remote Sensing and GIS Applications
13.03.17	CE010 801	Advanced Structural Design
16.03.17	CE010 802	Building Technology and Management
20.03.17	CE010 803	Environmental Engineering – 2
23.03.17	CE010 804L02	Environmental Geotechniques
23.03.17	CE010 804L04	Highway and Airfield Pavements
27.03.17	CE010 805G05	Numerical Methods
27.03.17	CE010 805G06	Remote Sensing and GIS Applications

CE010 801:

ADVANCED STRUCTURAL DESIGN

CE010 801: ADVANCED STRUCTURAL DESIGN

SYLLABUS

Teaching scheme: Credit: 4 3hours lecture and 2 hours tutorial per week

Objective: To familiarize students with behavior and design procedure of some of the special structural elements so that they can perform better in the analysis and design of these structures in practical situations.

Module 1 (15 Hrs)

Road bridges: IRC Loadings and Specifications-T beam bridges – box culvert (Design forIRC Class A Loading only)- Bearings(Theory only)

Module 2 (15 Hrs)

Shell structures: general principles for membrane theory for symmetrical uniformly distributed load- design of a simply supported single barrel cylindrical shell for membrane stresses. Folded plates: general principles- structural behaviour of plates (design not required)

Module 3 (14 Hrs)

Industrial buildings: roof loads- design of trusses (analysis not required) -design of purlins- design of bracings and supporting system. (Problems not expected.)

Module 4 (15 Hrs)

Design of Plate girders and gantry girders- welded compound sections

Module 5(16 Hrs)

Steel bridges: IS specifications-design of highway and railway bridges of plate girder type.(Design of bracings not required.) Note: Sketches only required for reinforcement details. Detailed drawing in drawing sheets not required.

REFERENCES

1. IRC Bridge code,Indian railway bridge code, IS 456.IS 800,IS 875
2. Victor J D, Design of concrete bridges, oxford & IBH publishing company,newdelhi
3. Krishna Raju, Advanced design of concrete structures, oxford & IBH publishing company,newdelhi
4. Ramchandra, Design of steel structures vol 2 standard book house, delhi
5. Ramaswamy G S Design and construction of concrete shell roofs, Mc Graw Hill

COURSE PLAN:

DAY	PLAN
	MODULE 1
Day 1	Introduction
Day 2	IRC Loadings and Specifications
Day 3	Design of slab bridge
Day 4	Design of slab bridge (contd)
Day 5	Design of slab bridge (contd)
Day 6	Introduction to T beam bridges
Day 7	Design of cantilever portion
Day 8	Design of deck slab
Day 9	Design of longitudinal girder
Day 10	Design of cross girder
Day 11	Introduction to Box culvert
Day 12	Design of box culvert
Day 13	Design of box culvert (contd)
Day 14	Design of box culvert (contd)
Day 15	Bearings(Theory only)
	MODULE 2
Day 16	Introduction to shells
Day 17	General principles for membrane theory for symmetrical uniformly distributed load
Day 18	Derivation for stresses
Day 19	Design procedure for a simply supported single barrel cylindrical shell for membrane stresses
Day 20	Problems of a simply supported single barrel cylindrical shell for membrane stresses
Day 21	Problem (contd)
Day 22	Problem (contd)
Day 23	Problems of shells to calculate the stresses
Day 24	Problem (contd)
Day 25	Problem (contd)
Day 26	Problem (contd)
Day 27	Introduction to folded plates
Day 28	General pricnciples
Day 29	Structural behaviour
Day 30	Types of folded plates

	MODULE 3
Day 31	Introduction to industrial buildings
Day 32	Brief description on roof loads
Day 33	Introduction to design of trusses
Day 34	Problems on design of trusses
Day 35	Problems on design of trusses
Day 36	Problems on design of trusses (contd)
Day 37	Problems on design of trusses (contd)
Day 38	Problems on design of trusses (contd)
Day 39	Design procedure of purlings (contd)
Day 40	Problems on design of purlins (contd)
Day 41	Problems on design of purlins (contd)
Day 42	Problems on design of purlins(contd)
Day 43	Problems on design of purlins(contd)
Day 44	Design on bracings and supporting systems
Day 45	Design on bracings and supporting systems (contd)
	MODULE 4
Day 46	Introduction to plate girders
Day 47	Design procedure of plate girders
Day 48	Problems on the design of plate girders
Day 49	Problems on the design of plate girders (contd)
Day 50	Problems on the design of plate girders (contd)
Day 51	Problems on the design of plate girders (contd)
Day 52	Problems on the design of plate girders (contd)
Day 53	Introduction to gantry girders
Day 54	Design procedure of gantry girders
Day 55	Problems on the design of gantry girders
Day 56	Problems on the design of gantry girders (contd)
Day 57	Problems on the design of gantry girders (contd)
Day 58	Problems on the design of gantry girders (contd)
Day 59	Problems on the design of gantry girders (contd)
Day 60	Problems on the design of gantry girders (contd)
	MODULE 5
Day 61	Introduction to steel bridges
Day 62	IS specifications
Day 63	Design procedure of highway through type bridge
Day 64	Problems on highway through type bridge
Day 65	Problems on highway through type bridge (contd)

Day 66	Problems on highway through type bridge (contd)
Day 67	Design procedure of highway deck type bridge
Day 68	Problems on highway deck type bridge
Day 69	Problems on highway deck type bridge(contd)
Day 70	Problems on highway deck type bridge(contd)
Day 71	Design procedure of railway through type bridge
Day 72	Problems on railway deck type bridge
Day 73	Problems on railway deck type bridge(contd)
Day 74	Design procedure ofrailwaydecktype bridge
Day 75	Problems on railway deck type bridge
Day 76	Problems on railway deck type bridge(contd)

CE010 802:

BUILDING TECHNOLOGY AND MANAGEMENT

CE010 802:BUILDING TECHNOLOGY AND MANAGEMENT

SYLLABUS

Teaching scheme: Credits: 4 2 hours lecture and 2 hours tutorial per week

Objective: To impart theoretical knowledge as well as awareness to practical concepts in project implementation giving emphasis on three essentials of project management; (1) avoiding time over-run, (2) avoiding cost over-run, (3) maintaining total quality management

Module 1 (12Hrs)

Concrete Mix Design: General concepts. BIS method of mix design, American standards of mix design, IS-method of mix design, Durability concepts in mix design - Requirements and tests of materials required for mix design.-Fibre reinforced concrete- High performance concrete. Form work. General arrangements – general requirements – common faults – materials for form work – form work arrangements – form work design – loads on forms – design procedure – form work vibration for compaction of concrete – stripping time and shoring.

Module 2 (12Hrs)

Prefabricated construction: Advantages, foundation units, wall panels, frames for opening, walls–units for roofs and floors – low cost roof systems. Hollow concrete blocks, Ferro cement – use and application – modular co-ordination – method of production – flow line method – station method – manufacturing process for structural units. Codification and Standerdisation- Value analysis: Various methods and techniques. Cost time analysis in Network Planning.

Module 3 (12Hrs)

Construction company organization: Different types of organizational set up – construction team – objectives of civil engineering management – duties and responsibilities of a civil engineer – functions of construction management. Technical planning. Site organization: Organization of labour, resources, materials, method of execution of the project – inspection and quality control-safety in construction.

Module 4 (12Hrs)

Materials Management: Functions of materials management – inventory control techniques. Construction contracts: Item rate contract – Lump-sum contract –Labour contract – Negotiated contract – Global contract – Percentage contract – Cost plus percentage contract- Cost plus fixed fee contract- Cost plus fluctuating fee contract – Target contract – All in contract.

Module 5 (12Hrs)

Claims manual for a construction organization: Law of contract - Extra work and deviation order – claims – owner' s claim – sub contractor' s claim – disputes and arbitration – consequences of mistake in contracts – terms and conditions of contract – contract documents – earnest money – security deposit – warranty period – contract signed under coercion – contract signed by minors, insane or drunken persons – authority to agree and find, validity of an oral agreement – conditions and warranties – express terms and implied terms – voidable contracts and their performance – illegal and voidable contracts – liability for tort in contract- litigation – breach of contract and remedies – discharge of contract – equity, privity of contract – transfer of contractual rights and obligations.

References

1. Gambhir. M. L, Concrete Technology, Mcgrawhill

2. M .S Shetty, concrete technology, S. Chand & Co.

3. A.R Santhkumar-Concrete Technology-Oxford University Press

4. S. P Arora, Building constructions, Dhanpat Rai & sons, New Delhi.

5. B. L Gupta, Amit Gupta, Construction Management and accounts, standard publishers and Distributions.

6. Construction Management and accounts – V .N Vazirani.

7. Construction Engineering & Management, S. Seetharaman, Umesh Publications, Delhi.

8. Donald S Barrie & Boyd C Paulson - Professional Construction Management, Mc Graw Hill

9. P.S. Gahlot&B.M.Dhir , Construction Planning and Management, New agw International

10. Knatson, Conctruction Management fundamentals, McGraw Hill.

COURSE PLAN

1	3	Day 1	Introduction -organisation
3	3	Day 2	Line organisation ,line and staff organisation,advantages,disadvantages
5	3	Day 3	Duties of a civil engineer,objectives of civil engg management
6	3	Day 4	functions of construction management
7	3	Day 5	Organisation of labour,resources,materials

8	3	Day 6	method of execution of project
9	3	Day 7	Inspection and quality control
10	3	Day 8	safety in construction
11	2	Day 9	seminar-concrete mix design
12	2	Day 10	BIS method of mix design
13	2	Day 11	American standards of mix design,durability concepts in mix design
14	2	Day 12	Requirement and tests for materials required for mix design
15	2	Day 13	Fibre reinforced concrete
16	2	Day 14	High performance concrete
17	2	Day 15	General requirements of concrete,common faults
18	2	Day 16	Design loads on form work,design procedure
18	2	Day 17	Design loads on form work,design procedure
18	2	Day 18	Design loads on form work,design procedure
19	2	Day 19	Form work vibration for compaction of concrete,stripping time and shoring
20	4	Day 20	Functions of material management
21	4	Day 21	Inventory control techniques
22	4	Day 22	Types of contracts
23	4	Day 23	Item rate contract,Lumpsum contract
24	4	Day 24	Labour contract ,Negotiable contract
25	4	Day 25	Global contract,percentage contract,cost plus percentage contract,cost plus fixed fee contract
26	4	Day 26	Cost plus fluctuating fee contract,target contract,All in contract
27	4	Day 27	revision -module4
28	4	Day 28	revision module-4

29	2	Day 29	Prefabricated construction,advantages,foundation units,wall panels
30	2	Day 30	walls,units for roofs and floors
31	2	Day 31	Low cost roof system,hollow concrete blocks
32	2	Day 32	Ferro cement-use and application,modular coordination
33	2	Day 33	Method of production
34	2	Day 34	flow line method,Station method
35	2	Day 35	manufacturing process for structural units
36	2	Day 36	reavision -module2
37	2	Day 37	Codification,standardisation
38	2	Day 38	Value analysis,Various methods and techniques
39	2	Day 39	Cost time analysis in net work planning
40	5	Day 40	Law of contract
41	5	Day 41	Claim-Owners claim,sub contractors claim
42	5	Day 42	Disputes and arbitration,terms and conditions of a contract
43	5	Day 43	Contract documents,earnest mkoney deposit,security deposit
44	5	Day 44	Warranty period,contract signed under coercion
45	5	Day 45	Validity of an oral agreement
46	5	Day 46	Illegal and voidable contract,liability for tort in contract
47	5	Day 47	litigation,breach of contract and remedies
48	5	Day 48	Discharge of contract,equity
49	5	Day 49	privity of contract,transfer of contractual rights and obligations
50	5	Day 50	revision
51	5	Day 51	revision

CE010 803:

ENVIRONMENTAL ENGINEERING - 2

CE010 803 : ENVIRONMENTAL ENGINEERING - 2

SYLLABUS

Teaching scheme: Credits: 4 2 hours lecture and 2 hours tutorial per week

Objective: • To understand the basic principles of Wastewater Engineering • To develop knowledge in unit operations and design of wastewater treatment systems

Module 1 (10hrs)

Introduction to sanitary engineering. Sewerage systems – separate, combined and partially combined systems. Quantity of sewage: sanitary sewage - sources, factors affecting. Fluctuations in sewage flow, peak factor. Characteristics of sewage: physical, chemical and biological characteristics and analysis. population equivalent, relative stability. Storm sewage: Factors affecting, intensity of rainfall, rational and empirical formula, time of concentration, intensity - duration curve and formula. Design of sewers: Flow formula, minimum and maximum velocity of flow, effect of variation of discharge on velocity, use of partial flow diagrams, design of circular sewers, longitudinal and cross section of sewer lines.

Module 2 (10hrs)

Construction of sewers: Materials of sewers, crown corrosion. Sewer appurtenances: inlets, catch basins, clean outs, manholes, drop manholes, lamp holes/flushing tanks, grease and oil traps, inverted siphons, storm regulators. Sewage pumping: classification and capacity of pumps. Natural methods of wastewater disposal: land disposal -. Sewage farming - disposal by dilution - self purification of streams - oxygen sag curve - dilution into sea, comparison of disposal methods.

Module 3 (10hrs)

Objectives of waste water treatment - Effluent standards, KSPCB Standards, BIS Standards. Layout of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general. Screens - types of screens, design, disposal of' screenings; comminutors. Grit chamber - function, design, construction and operation, disposal of grit, detritus tank. Skimming tank -function, design and operation, disposal of skimmings Sedimentation: Theory of sewage sedimentation - design, construction and operation, rectangular and circular tanks, disposal of sludge.

Module 4 (15hrs)

Biological process: principle and theory of biological treatment. Sewage filtration: Trickling filters - design, construction and operation. Activated sludge process: Design, construction and

operation of conventional and extended aeration, aeration methods. Miscellaneous methods- Stabilization ponds, Oxidation ditch, Aerated lagoons, rotating biological contactors; disinfection of sewage effluents.

Module 5 (15hrs)

Sludge treatment and disposal: quantity of sludge, characteristics of sludge, sludge thickening, digestion, conditioning and disposal, design of sludge digesters only. Septic Tanks: Design (as per Ministry of urban development) construction, disposal of effluents, cleaning of tanks, Imhoff tanks. Sewage treatment by high rate anaerobic methods: Anaerobic digestion, suspended growth, contact process, UASB, attached growth, filters, expanded bed - only basics.

References

1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.

2. S. K. Garg, Environmental Engineering Vol. l &ll, Khanna Publishers, New Delhi.

3. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.

4. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.

5. Metcalf & Eddy, Waste water Engg.- Treatment and Reuse, 4th Edn., Mc Graw Hill International Editions.

6. Mark J Hammer, Water and waste water technology, John Wiley and sons, Inc.

COURSE PLAN

Day	Module	Course Plan
1	I	Introduction to sanitary engineering
2	I	Sewerage systems – separate, combined and partially combined systems.
3	I	Quantity of sewage: sanitary sewage - sources, factors affecting. Fluctuations in sewage flow, peak factor
4	I	Characteristics of sewage: physical, chemical and biological characteristics and analysis. population equivalent, relative stability.
5	I	Storm sewage: Factors affecting, intensity of rainfall, rational and empirical formula, time of concentration, intensity - duration curve and formula.
6	I	Design of sewers: Flow formula, minimum and maximum velocity of flow
7	I	Effect of variation of discharge on velocity, use of partial flow diagrams
8	I	Design of circular sewers, longitudinal and cross section of sewer lines

9	I	Design of circular sewers, longitudinal and cross section of sewer lines
10	I	Design of circular sewers, longitudinal and cross section of sewer lines
11	II	Construction of sewers: Materials of sewers, crown corrosion
12	II	Sewer appurtenances: inlets, catch basins, clean outs, manholes, drop manholes,lamp holes/flushing tanks
13	II	Sewer appurtenances:grease and oil traps, inverted siphons, storm regulators
14	II	Sewage pumping: classification and capacity of pumps
15	II	Natural methods of wastewater disposal: land disposal -. Sewage farming
16	II	Natural methods of wastewater disposal:disposal by dilution - self purification of streams
17	II	Natural methods of wastewater disposal:oxygen sag curve - dilution into sea, comparison of disposal methods
18	III	Objectives of waste water treatment - Effluent standards, KSPCB Standards, BIS Standards.
19	III	Layout of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general.
20	III	Screens - types of screens, design, disposal of' screenings; comminutors
21	III	Grit chamber - function, design, construction and operation, disposal of grit, detritus tank.
22	III	Grit chamber - function, design, construction and operation, disposal of grit, detritus tank.
23	III	Skimming tank -function, design and operation, disposal of skimmings
24	III	Skimming tank -function, design and operation, disposal of skimmings
25	III	Skimming tank -function, design and operation, disposal of skimmings
26	III	Sedimentation: Theory of sewage sedimentation
27	III	Sedimentantion tank design, construction and operation, rectangular and circular tanks, disposal of sludge
28	III	Sedimentantion tank design, construction and operation, rectangular and circular tanks, disposal of sludge
29	III	Sedimentantion tank design, construction and operation, rectangular and circular tanks, disposal of sludge
30	IV	Biological process: principle and theory of biological treatment
31	IV	Sewage filtration: Trickling filters - design, construction and operation
32	IV	Sewage filtration: Trickling filters - design, construction and operation
33	IV	Activated sludge process: Design, construction and operation of conventional and extended aeration, aeration methods
34	IV	Activated sludge process: Design, construction and operation of conventional and extended aeration, aeration methods

35	IV	Miscellaneous methods- Stabilization ponds,Oxidation ditch, Aerated lagoons, rotating biological contactors; disinfection of sewage effluents
36	V	Sludge treatment and disposal: quantity of sludge, characteristics of sludge,sludge thickening
37	V	Sludge digestion, conditioning and disposal, design of sludge digesters
38	V	Septic Tanks: Design (as per Ministry of urban development) construction,disposal of effluents, cleaning of tanks, Imhoff tanks
39	V	Septic Tanks: Design (as per Ministry of urban development) construction,disposal of effluents, cleaning of tanks, Imhoff tanks
40	V	Sewage treatment by high rate anaerobic methods: Anaerobic digestion
41	V	Sewage treatment by high rate anaerobic methods: suspended growth,contact process
42	V	Sewage treatment by high rate anaerobic methods:UASB, attached growth, filters, expanded bed

CE010 804L02: ENVIRONMENTAL GEOTECHNIQUES

CE010 804L02 : ENVIRONMENTAL GEOTECHNIQUES

SYLLABUS

Teaching scheme: Credit: 4 2 hours lecture and 2 hours tutorial per week

Objective: Waste disposal is a major issue for which we need different effective and innovative methods. The objective is to familiarise the students, the different types of wastes generated , composition of the wastes, and the problems they pose on environment due to improper disposal. It also includes the different effective methods for the disposal for the different types of wastes.

Module 1 (12 hours)

Clay mineralogy and soil structure: Gravitational and surface forces-inter sheet and inter layer bonding in the clay minerals- Basic structural units of clay minerals- isomorphous substitution – kaolinite mineral- montmorillonite mineral -illite mineral- electric charges on clay minerals – base exchange capacity ,diffused double layer- adsorbed water- soil structure- methods for the identification of minerals (introduction only).

Module 2 (15 hours)

Effect of environment on Geotechnical properties of soils: Effect of drying on Atterberg limits.-Volume change behaviour- factors controlling resistance to volume change- general relationship between soil type, pressure and void ratio.- importance of mineralogical composition in soil expansion. Activity- sensitivity ,causes of sensitivity- Influence of exchangeable cations , pH and organic matter on properties of soils. Permeability of soils- hydraulic conductivity of different types of soils – Darcy' s law and its validity- factors affecting permeability

Module 3 (10hours)

Wastes and Contaminants (introduction only): sources of wastes-types of wastes composition of different wastes- characteristics and classification of hazardous wastes- generation rates- ground water contamination- sources of ground water contamination- transport mechanisms-potential problems in soils due to contaminants.

Module 4 (12 hours)

Disposal and containment technics: Criteria for selection of sites for waste disposal- hydrological aspects of selection of waste disposal sites- disposal facilities- subsurface disposal technics-disposal systems for typical wastes (sketches only)

Module 5 (12 hours)

Containment control systems-Liners and covers for waste disposal- rigid liners, flexible liners. Ground modification technics in waste management – waste modification- ground modification- mechanical modification-hydraulic modification- chemical modification.

References

1. Mitchell, J (1976), " Fundamentals of soil behaviour", John Wiley and sons, NewYork

2. Lambe, T. W & Whitman, R. V (1979), " Soil Mechanics ", John Wiley and Sons, New York.

3. Gopal Ranjan& A.S.R Rao (1991), " Basic and Applied Soil Mechanics, Wiley Eastern Ltd., New Delhi.

4. Wilson, M. J (1987), " A Hand book of Determinative methods in Clay Mineralogy", Chapman and Hall, New York.

5. Robert M. Koerner (1984), "Construction and Geotechnical methods in Foundation Engineering", McGraw Hill Book Co., New York.

CE010 804L05:

HIGHWAY AND AIRFIELD PAVEMENTS

CE010 804L05 : HIGHWAY AND AIRFIELD PAVEMENTS

SYLLABUS

Teaching scheme: Credit: 4 2 hours lecture and 2 hours tutorial per week

Objective: To equip the students to carry out design and evaluation of flexible and rigid pavements in varied field conditions.

Module 1 (12hrs)

Pavement types: stress distribution in pavements - theoretical subgrade conditions and traffic loadings Basic difference between flexible and rigid pavements - design factors - wheel load - equivalent single wheel load - repetition of loads - elastic modulii - climatic variations.

Module 2 (12hrs)

Design of flexible pavements: group index method - CBR method - IRC recommendations - Me Load method - Burmister's layer theory.

Module 3 (12hrs)

Design of rigid pavements: radius of relative stiffness - critical load positions - Westergaard's stress equation - Bradley's stress coefficients - design charts.

Module 4 (12hrs)

Temperature stresses in concrete pavements: Westergaard's concept - wrapping stress - functional stress - combination of stresses. Design of joints in concrete pavements: expansion joints - construction joints - design of dowel bars - tie bars - IRC recommendation.

Module 5 (12hrs)

Evaluation of pavement condition: pavement instrumentation - types of pavement distress - roughness and skid resistance. Environmental influence and effects-pavements maintenance and overlays.

References

1. Bindra B.S, Highway Engineering, Danpat Rai and Sons.

2. H.J.Yoder, Principles of Pavement Design, John wiley and sons

3. Khanna O.P, Justo C.G., Highway Engineering, Nem Chand Publishers

4. IRC Standard specifications for Construction of Flexible and rigid pavements

COURSE PLAN

MODULE	TOPICS	HOURS
1	Pavement types - Basic difference between flexible and rigid pavements	2
	stress distribution in pavements	3
	theoretical subgrade conditions and traffic loadings	2
	design factors - wheel load - equivalent single wheel load - repetition of loads - elastic modulii - climatic variations	2
2	Design of flexible pavements: group index method	2
	CBR method	2
	IRC recommendations	2
	MC Load method	2
	Burmister's layer theory	2
3	Design of rigid pavements: radius of relative stiffness critical load positions	3
	Westergaard's stress equation	2
	Bradley's stress coefficients - design charts.	2
4	Temperature stresses in concrete pavements: Westergaard's concept - wrapping stress - functional stress - combination of stresses	3
	Design of joints in concrete pavements: expansion joints - construction joints	3
	design of dowel bars - tie bars - IRC recommendation.	3
5	Evaluation of pavement condition: pavement instrumentation	2
	-types of pavement distress	2
	roughness and skid resistance	2
	Environmental influence and effects	2
	pavements maintenance and overlays	2

CE010 805G05:
NUMERICAL METHODS

CE010 805G05 :NUMERICAL METHODS

SYLLABUS

Teaching scheme: Credit: 4 2 hours lecture and 2 hours tutorial per week

Objective To impart the basic concepts of mathematical modeling of problems in science and engineering and to know procedures for solving different kinds of problems. To understand the various numerical techniques which provide solutions to non linear equations, partial differential equations etc that describe the mathematical models of problems.

Module I (10 hours)

Solution of linear equations:- Review of Gaussian elimination and Cholesky methods- storage schemes – substructure concept- sub matrix equation solver

Module 2 (12 hours)

Solution technique for Eigen value problem:- Introduction – forward iteration, inverse iteration, Jacobi's method

Module 3 (13 hours)

Numerical Interpolation& Integration – Introduction – Lagrange, Hermitian and isoparametric style of interpolation. Numerical integration - trapezoidal rule - Simpson 1/3 rule - Simpson 3/8 rule - Gauss quadrature formula – weights and Gauss points

Module 4 (12 hours)

Finite difference techniques:-Finite difference method, ,Newton's method, Variational and weighted residual methods

Module 5 (13 hours)

Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear regression

References

1. BalagurusamyE , Numerical Methods, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

2. Gerald C.F. and Wheatley P.O., Applied Numerical Analysis, 6th Ed., Pearson Education Asia, New Delhi, 2002.

3. Rajasekharan S, Numerical Methods in Science and Engineering, A practical Approach, A.H. Wheeler &Co

4. K.J. Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall,

5. Jain M.K., Iyengar S.R.K. &Jain R.K, Numerical Methods for Science and Engineering, Prentice Hall of India 6. SaumyenGuha& Rajesh Srivastava, Numerical Methods for Engineering and Science, Oxford University Press.

COURSE PLAN

Sl.No	DAY	Module	Planned
1	DAY 1	1	SOLUTION OF LINEAR EQUATIONS
2	DAY 2	1	GAUSSIAN ELIMINATION METHOD
3	DAY 3	1	GAUSS JACOBIE'S METHOD
4	DAY 4	1	LU DECOMPOSITION
5	DAY 5	1	CHOLESKY METHODS
6	DAY 6	1	STORAGE SCHEME, SUBSTRUCTURE CONCEPTS.
7	DAY 7	1	SUB MATRIX EQUATION SOLVER
8	DAY 8	1	TOUTORIAL

9	DAY 9	2	SOLUTION TECHNIQUES FOR EIGEN VALUE PROBLEMS.
10	DAY 10	2	PROBLEMS
11	DAY 11	2	FORWARD ITERATION
12	DAY 12	2	PROBLEMS - TOUTORIAL
13	DAY 13	2	FORWARD ITERATION
14	DAY 14	2	INVERSE ITERATION
15	DAY 15	2	JACOBIE'S METHOD
16	DAY 16	2	PROBLEMS - TOUTORIAL
17	DAY 17	3	NUMERICAL INTERPOLATION & INTEGRATION
18	DAY 18	3	LAGRANGE, HERMITION AND ISOPARAMETRIC INTERPOLATION
19	DAY 19	3	PROBLEMS
20	DAY 20	3	TRAPIZOIDEL RULE

21	DAY 21	3	SIMPSON'S 1/3 RULE
22	DAY 22	3	SIMPSON'S 3/8 RULE
23	DAY 23	5	FITTING A STRAIGHT LINE
24	DAY 24	3	WEIGHTS AND GAUSS POINTS.
25	DAY 25	4	FINITE DIFFERENCE TECHNIQUES
26	DAY 26	4	PROBLEMS TOUTORIAL
27	DAY 27	4	NEWTON'S METHOD
28	DAY 28	4	VARIATIONAL AND WEIGHTED RESIDUAL METHOD
29	DAY 29	4	PROBLEMS
30	DAY 30	4	TOUTORIAL
31	DAY 31	5	STATISTICAL COMPUTATION
32	DAY 32	5	FREQUENCY CHART

33	DAY 33	5	LEAST SQUARE CURVE FITTING PROCEDURES
34	DAY 34	5	CURVE FITTING BY SUM OF EXPONENTIAL
35	DAY 35	5	DATA FITTING WITH CUBIC SPLINES
36	DAY 36	5	APPROXIMATION OF FUNCTIONS
37	DAY 37	5	TOUTORIAL
38	DAY 38	5	REGRESSION ANALYSIS
39	DAY 39	5	LINEAR REGRESSION
40	DAY 40	5	PROBLEMS.

CE010 805G06:

REMOTE SENSING AND GIS APPLICATIONS

CE010 805G06 :REMOTE SENSING AND GIS APPLICATIONS

SYLLABUS

Teaching scheme Credit: 4 2 hours lecture and 2 hours tutorial per week.

Objective To make the students aware of the technological developments in the geographical database management and its advantages.

Module 1 (13hours)

Remote sensing: definition- components of remote sensing- energy sensor, interacting bodyactive and passive remote sensing- platforms- Arial and space platforms- balloons, helicopters, aircrafts and satellites- electromagnetic radiation(EMR)- EMR spectrum- visible, infrared(IR) ,near IR, middle IR, thermal IR and microwave- black body radiation- Plancks Law- StefanBoltzman law.

Module 2 (12hours)

Atmospheric characteristics- scattering of EMR- Raliegh, Mie, Non-selective and Raman scattering- EMR interaction with water vapour and ozone- atmospheric windows- significance of atmospheric windows- EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy- reflectance- specular and diffused reflection surfaces- spectral signature- spectral signature curves- EMR interaction with water, soil and earth surface.

Module 3 (12hours)

Optical and Microwave Remote sensing: Satellites- classification- based on orbits- sun synchronous and geo synchronous- based on purpose- earth resources satellites, communication satellites, weather satellites, spy satellitessatellite sensors- resolution- spectral, spatial, radiometric and temporal resolution- description of multi-spectral scanning- along and across track scanners- description of sensors in IRS seriescurrent satellites- radar- speckle- back scattering- side looking air borne radar- synthetic aperture radar- radiometer radar- geometrical characteristics. Principles of thermal remote sensingPrinciples of microwave remote sensing.

Module 4 (12hours)

Geographic information system- components of GIS- hardware, software and organizational context- data- spatial and non spatial maps- types of maps- projection- types of projection- data input- digitizer, scanner, editing- raster and vector data structures- comparison of raster and vector data structure- analysis using raster and vector data- retrieval, reclassification, overlaying, buffering- data output- printers and plotters.

Module 5 (12hours)

Miscellaneous topics: interpretation of satellite images- elements of interpretation- visual interpretation- digital image processing techniques- image enhancement- filtering- image classification- FCC composites- supervised and unsupervised integration of GIS and remote sensing- application of remote sensing and GIS- urban applications- water resources- urban analysis- watershed management- resources information system- hazard mitigation.

References:

1. Thomas M.Lillesand&RaiphW.Kiefer,"remote sensing and image interpretation",John Wiley Sons.

2. Floyd F. Sabins, "Remote sensing principles and interpretation", Freeman And Company.

3. AnjiReddy,"Remote sensing and geographical systems",BS Publications.

4. M.G.Srinivas (Edited by),"Remote Sensing Applications", Nerusa publications.

5. JensanJ.R.,"Introductory Digital Image Processing",Prentice Hall of India.

COURSE PLAN

SL NO:	DAY	MODULE	PORTION PLANNED
1	Day 1	1	Remote sensing: definition- components of remote sensing- energy sensor, interacting body
2	Day 2	1	Active and passive remote sensing- platforms- Arial and space platforms- balloons, helicopters,aircrafts and satellites
3	Day 3	1	electromagnetic radiation(EMR)- EMR spectrum- visible, infrared(IR),near IR, middle IR, thermal IR and microwave- black body radiation
4	Day 4	1	Plancks Law- Stefan-Boltzman law.
5	Day 5	2	Atmospheric characteristics- scattering of EMR- Raliegh, Mie, Non-selective and Raman scattering
6	Day 6	2	EMR interaction with water vapour and ozone- atmospheric windows- significance of atmospheric windows
7	Day 7	2	EMR interaction with earth surface material, radiance, irradiance,incident, reflected, absorbed and transmitted energy
8	Day 8	2	reflectance- specular and diffused reflection surfaces- spectral signature- spectral signature curves-
9	Day 9	2	EMR interaction with water, soil and earth surface.
10	Day 10	3	Optical and Microwave Remote sensing: Satellites- classification- based on orbits- sun synchronous and geo

			synchronous
11	Day 11	3	based on purpose- earth resources satellites, communication satellites, weather satellites, spy satellites
12	Day 12	3	satellite sensors- resolution- spectral, spatial, radiometric and temporal resolution
13	Day 13	3	description of multi-spectral scanning- along and across track scanners
14	Day 14	3	description of sensors in IRS seriescurrent satellites- radar- speckle- back scattering- side looking air borne radar- synthetic aperture radar- radiometer radar- geometrical characteristics.
15	Day 15	3	Principles of thermal remote sensing-Principles of microwave remote sensing.
16	Day 16	4	Geographic information system- components of GIS- hardware, software and organizational context-
17	Day 17	4	data- spatial and non spatial maps- types of maps- projection- types of projection
18	Day 18	4	data input- digitizer, scanner, editing- raster and vector data structures- comparison of raster and vector data structure
19	Day 19	4	analysis using raster and vector data- retrieval, reclassification, overlaying, buffering- data output- printers and plotters.
20	Day 20	5	Miscellaneous topics: interpretation of satellite images- elements of interpretation- visual interpretation-
21	Day 21	5	digital image processing techniques- image enhancement- filtering- image classification
22	Day 22	5	FCC composites- supervised and unsupervised integration of GIS and remote sensing
23	Day 23	5	application of remote sensing and GIS- urban applications- water resources
24	Day 24	5	urban analysis- watershed management
25	Day 25	5	resources information system- hazard mitigation

CE010 806:

ENVIRONMENTAL ENGINEERING LAB

CE010 806 :ENVIRONMENTAL ENGINEERING LAB

SYLLABUS

Teaching scheme Credits: 2- 3 hours practical per week

Objective: To make students familiar with laboratory tests for water and waste water quality assessment.

List of Experiments

1. Determination of alkalinity of water.
2. Determination of hardness of water.
3. Determination of acidity of water.
4. Determination of iron.
5. Determination of sulphates.
6. Determination of Chlorine demand and residual chlorine.
7. Determination of chlorides in water.
8. M. P. N. of Fecal coliforms using A-l medium
9. D.O. and Biochemical Oxygen Demand.
10. Chemical oxygen demand.
11. Determination of solids - total, suspended, dissolved, fixed, volatile, settleable and SVI.
12. Determination of Turbidity and estimation of optimum coagulant dosage by jar test.
13. Determination of pH

Reference:

1. "Standard methods for the examination of water and wastewater" 1995, ALPHA, AWWA, WPCF Publication.
2. "Chemistry for Environmental Engineering"- Sawer and McCarty, McGraw Hill.
3. "Manual of standards of quality for Drinking Water Supplies"- Indian Council of Medical Research, New Delhi.
4. "International Standards of Drinking Water" – W.H.O.
5. "IS 2490-1981, IS 3306- 1974, IS 3307-1977, IS 7968-1976, IS 2296-1974, IS 10500-1991" Bureau of Indian Standards, New Delhi, Effluent Standard KSPCB.

COURSE PLAN

Day	Cycle	Course Plan
1	I	Determination of Alkalinity, Acidity, pH
2	I	Determination of Hardness, Chloride

3	II	Determination of Optimum Coagulant Dosage
4	II	Determination of Iron, Sulphate
5	II	Determination of Chemical Oxygen Demand
6	II	Determination of Solids
7	II	Determination of Chlorine Demand and Residual Chlorine
8	II	Determination of Dissolved oxygen and Biological Oxygen Demand
9	II	MPN test for fecal coliforms
10	I&II	Quick revision of all the experiments