SCHEME AND SYLLABI FOR

EIGHTH SEMESTER

OF

BACHELOR OF TECHNOLOGY IN
CIVIL ENGINEERING

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

8th Semester

Sl. No	Code	Subject	Hours / week			Marks		Sem-end Duration Hours	Credits
			L	T	P/D	Inte - rnal	S em- end		
1	CE09 801	Environmental Engineering II	4	1	-	30	70	3	5
2	CE09 802	Quantity Survey & Valuation	2	1	-	30	70	3	3
3	CE09 Lxx	Elective IV	3	1	-	30	70	3	4
4	CE09 Lxx	Elective V	3	1	-	30	70	3	4
5	*CE09 805(P)*	Seminar	-	-	3	100	-	3	2
6	*CE09 806(P)*	Project	-	-	11	100	-	3	7
7	*CE09 807(P)*	Viva Voce	-	-	-	-	100	3	3
		Total	**12**	**4**	**14**				**28**

Electives for 7th and 8th Semesters

CE09 L06 Advanced Structural Design I
CE09 L07 Advanced Structural Design II
CE09 L08 Advanced Geotechnical Engineering I
CE09 L09 Advanced Geotechnical Engineering II
CE09 L10 Highway Pavement Design
CE09 L11 Ecology and Environmental Chemistry
CE09 L12 Industrial Structures
CE09 L13 Structural Dynamics & Seismic Design
CE09 L14 Soil Exploration, Testing and Evaluation
CE09 L15 Surface Hydrology and Water Power
CE09 L16 Urban Transportation Planning
CE09 L17 Architecture and Town Planning
CE09 L18 Advanced Construction Engineering and Management
CE09 L19 Coastal Engineering & Marine Structures
CE09 L20 Ground Water Hydrology
CE09 L21 Ground Improvement Techniques
CE09 L22 Environmental Pollution Control Engineering*
CE09 L23 Experimental Stress Analysis*
CE09 L24 Remote Sensing and GIS*
CE09 L25 Finite Element Methods*

Global Electives

CS09 L24 Computer Based Numerical Methods
PE09 L24 Industrial Psychology
PE09 L25 Entrepreneurship
ME09 L22 Quality Engineering and Management
ME09 L25 Energy Engineering and Management
ME09 L23 Industrial Safety Engineering
AN09 L24 Project Management
CH09 L24 Industrial Pollution Control
EC09 L23 Data Structures and Algorithms
EE09 L22 Soft Computing Techniques

CE 09 801: ENVIRONMENTAL ENGINEERING II

Teaching scheme **Credits:** 5
4 hours lecture and 1 hour tutorial per week

Objectives

- To expose students to the area of waste treatment – with emphasis on domestic liquid wastes – its characterisation, collection, treatment and disposal at individual household level to community level - rural and urban.
- To impart the basic concepts of solid waste management and air pollution control.

Module I (18 Hours)
Waste water engineering – sanitary pumping – closets – urinals – wash basins – sinks – baths – traps – soil pipes – waste water pipes –systems of piping – pipe joints and pipe fittings – public lavatories and toilets in factories, railway stations, bus stations and air ports.

House drainage – principles of house drainage – inspection chambers – ventilation – testing of drains – connection of house drains and street sewer.

Systems of sewerage – separate – combines and partially combined systems – quantity of storm sewage – source of sewage – relation to water consumption – ground water infiltration –fluctuations of sewage flow – quantity of storm sewage – factors affecting storm water sewage – determination of storm water flow – time of concentration – sewers and sewer appurtenances – materials used in the construction of sewers – shape of sewers – hydraulics of sewers – design of sewers – manholes, inlets, catch basins, grease traps – regulators – leaping weirs – side weirs – siphon spillway - inverted siphons – sewage pumps – pumping stations – ejectors – sewer junctions – outlets - maintenance of sewers – cleaning of sewers- ventilation of sewers.

Module II (17 Hours)
Characteristics of sewage – physical, chemical and biological characteristics – physical and chemical analysis –sampling – population equivalent – characteristics of industrial wastes – treatment of wastewater – screens – grit chambers – detritus tank – skimming tanks – sedimentation tanks – oxidation ponds – design construction and operation of trickling filters, activated sludge treatment units – disinfection of sewage.

Module III (18 Hours)
Sewage disposal, dilution disposal into stream – pollution assimilation capacity of streams – disposal by irrigation – surface and subsurface irrigation.

Sludge treatment and disposal, quality of sludge – characteristics of sludge – sludge elutriation – sludge conditioning – vacuum filtration – sludge digestion – disposal of sludge.

Rural sanitation – conservancy and water carriage systems – sanitary latrines – septic tanks – (Design as per I.S. specification)

Module IV (19 Hours)
Solid waste management – solid waste collection – transportation and processing - types and sources of solid waste – solid waste characteristics – automation and mechanism of refuse collection – vehicles for solid waste collection and transportation - solid waste disposal – composting – incineration – sanitary landfill – prevention of malaria incidental to engineering construction.

Gaseous waste management (air pollution and control) – air pollution and health – types of pollutants and their source – air pollution control strategy – basic approaches – areas of legal responsibility – source identification – particulate control and control of gases and vapors.

Text Books

1. Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons.
2. Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd.
3. Garg S K, Environmental Engineering Vol II, Khanna Publishers.

Reference Books

1. Elhers and Steel, Municipal and Rural Sanitation, McGraw Hill.
2. Sawer and McCarty, Chemistry for Environmental Engineering, McGraw Hill.
3. Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley.
4. Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE 09 802: QUANTITY SURVEY AND VALUATION.

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

After studying the subject, the student should be able

1. To set out any civil engineering work which is the primary duty that is to be performed by a civil engineer in the construction field
2. To prepare detailed exact as well as approximate estimates to meet a number of requirements and also to have a clear picture of the project expenditure.
3. To have a thorough idea regarding the quality and quantity of materials, quantity and classes of skilled and unskilled labours and tools and plants required for the project.
4. To calculate the exact quantities of items of work done for affecting payment especially when direct measurements are difficult
5. To draw up specifications for the different items of civil engineering project and also to prepare the schedule of programming of the project.
6. To prepare valuation report of real and landed property

To mould themselves as entry level graduate engineers competent to manage any civil engineering project confidently either alone of jointly.

Module I (9 Hours)

Estimate – Basic terms - Types of estimate - Revised estimate - supplementary estimate - maintenance estimate - approximate estimate - plinth area method - cubic rate method - unit rate method - bay method - approximate quantity from bill method - comparison method - cost from materials and labour etc. - preparation of detailed estimate for buildings - centre line method and ‘long wall - short wall’ method .

Module II (9 Hours)

Methods of measurements of different items of work - Preparation detailed estimate for sanitary and water supply works - roads - irrigation works - steel structures - doors and windows - R C C Structures - Preparation of bar bending schedule.

Modul III (9 Hours)

Detailed specifications for common building materials and items of work as per I.S specifications -

Preparation of conveyance statement - Calculation of quantities of materials for items of work - Analysis of rate for items of works required for civil engineering works - Preparation of abstract of estimate of civil engineering works.

Module IV (9 Hours)

Valuation - Explanation of items - types of values - sinking fund - years purchase - Depreciation - straight line method - constant percentage method - S.F method - obsolescence - valuation of real property - rental method - profit based method - depreciation method - valuation of land - belting method - development method - hypothecated building scheme method - rent calculation - lease and lease hold property.

Text books

1. M.Chakraborthi, Estimating costing & Specification in Civil Engineering
2. B.M.Dutta, Estimating and costing in civil engineering
3. S.C. Rangawala, Valuation of real properties

References

1. I.S.1200-1968 Methods of measurements of buildings and Civil Engineering works
2. Latest schedule of rates of Kerala P.W.D
3. Latest Data book of Kerala P.W.D

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE 09 803 Lxx: ELECTIVE IV.

CE 09 804 Lxx: ELECTIVE V.

CE 09 805: SEMINAR

Conducting schedule **Credits: 2**

3 hours presentations per week

Objective

To measure as well as flourish the ability of the student to study a current and relevant topic in Civil Engineering from technical literature and present a seminar on that topic.

Individual students should be asked to choose a topic in any field of civil engineering, preferably from outside the B. Tech syllabus and give a seminar on that topic for about thirty minutes It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report (in two copies), based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members (preferably specialized in different sub-fields of Civil Engineering) will evaluate the seminar. One of the two copies submitted by the student should be returned to him/her after duly certifying it by the chairman of the assessing committee and the other shall be kept in the departmental library.

Internal Continuous Assessment

20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar

CE 09 806(P): PROJECT

Teaching scheme **Credits: 7**

11 hour per week

The project work started in the seventh semester will continue in this semester. The students should complete the project work in this semester and present it to the assessing committee (as constituted in the seventh semester). The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through 'progress seminars' and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each student is expected to prepare a report in the prescribed format, for final evaluations based on the project work. Members of the project group will present the relevance, design, implementation, and results of the project to the project evaluation committee.

Each group will submit the copies of the completed project report signed by the guide to the department. The head of the department will certify the copies and return them to the students. One copy will be kept in the departmental library and one by the respective guide. The assessment committee and project guides will award the marks for the individual students in a project as follows: 50% of the marks is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment

40% - Data collection, Planning/ Design and detailing/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

CE 09 807(P): VIVA VOCE.

Objective **Credits:** 3

- *To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination*

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. course, seminar, and project. There is only university examination for this. The university will appoint two external examiners and an internal examiner for conducting the viva voce examination. These examiners shall be senior faculty members having minimum five years of teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of seminar and project (two interim reports and main report). If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce. The examiners will ask questions from subjects studied for the B.Tech course, project, seminar and reports of industrial visits/trainings conducted by the student. Allotment of marks for viva-voce shall be as given below.

Assessment in Viva-voce

40% - Subjects
30% - Project
20% - Seminar
10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

Pass minimum is 50%

Note: A student failed in viva voce but had passed in all other subjects shall be given with an additional chance for appearing the viva voce examination with in three months from the date of examination.

ELECTIVES

CE 09 L06: ADVANCED STRUCTURAL DESIGN I

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

- To equip the students to assess the loads on some important types of structures, choose the method of appropriate analysis according to the situation and perform design

Module-1 (12 Hours)

Design of Deep beams & Corbels

Design of Ribbed Slabs

Yield line theory of slabs – Design of Square, Rectangular & Circular slabs for UDL and point load at centre

Module –II (14 Hours)

Design of flat slabs by direct design method and equivalent frame method as per IS 456-2000.

Design of multi-bay multi storied portal frames for gravity loads, Pattern loading - Use of SP 16 (Substitute Frame method of analysis may be followed)

Module III (14 Hours)

Design of Light Gauge members – compression and flexural members

Design of Self Supporting & Guyed steel Chimney (design for wind dynamics not expected)

Module – IV (14 Hours)

Basic principles of analysis of Base-excited SDOF and MDOF systems - formulation of basic equation– concepts of pseudo acceleration, velocity and displacement - Earthquake response spectra (concept only) .

Lumped mass modelling of multi-storey shear building and modes of vibration (concepts only-demonstration with example- students are not expected to solve numerical problem on evaluation of modes during examination)-modes superposition- SRSS and CQC (Introduction only)-Concept of design spectrum for earthquake- use of IS 1893.

Design of Multistoried framed structures for wind and Earthquake Loads- Equivalent static load method of IS 1893.

Ductility detailing for earthquake forces- IS 13920

Note

1. All designs shall be done as per current I.S. specifications.
2. Special importance shall be given to detailing in designs.
3. Limit state design shall be practiced wherever possible
4. Use of I.S. codes (IS 456, IS 801, IS 811, IS 1893) and SP16 (Design Aids) shall be permitted in the examination hall.

Text books

1. Varghese P.C., Advanced Reinforced Concrete Design , PHI
2. Winter and Nelson, Design of Concrete Structures, Tata McGraw Hill
3. Arya and Ajmani, Design of Steel Structures, Nemchand & Bros.
4. Anil K Chopra, Dynamics of structures-theory and applications to earthquake engineering, Pearson Education
5. R W Clough and J Penzien, Dynamics of structures, McGraw Hill
6. Jaykrishna, Elements of earthquake engineering, Saritha Prakasan, Naunchandi, Meerut.

Reference books

1. Krishnaraju.N., Advanced Reinforced Concrete Design, CBS Publishers
2. Mallick S.K. & Gupta A.P., Reinforced Concrete, Oxford & IBH Publishing Co.
3. Jain and Jaikrishna, Plain & Reinforced Concrete Vol.I & 11, Nem Chand
7. Ferguson, Reinforced Concrete, Wiley Eastern
8. Ramchandra, Design of Steel Structures Vol. II, Standard Book House
9. Park and Paulay, Reinforced Concrete Structures
10. Pankaj Agarwal and Manish Shrikandhe, Earthquake Resistant Design of Structures, PHI

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Note: No charts, tables, codes are permitted in the Examination hall .If necessary relevant data shall be given along with the question paper by the question paper setter.

Maximum Total marks: 70

CE 09 L07: ADVANCED STRUCTURAL DESIGN II

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

To familiarize the students with analysis & design aspects of some advanced structures like shell roofs, tall buildings and pre-stressed concrete structures

Module 1 (15 Hours)

Shell Roof – Introduction-Classification of shells, types of stresses, Analysis of cylindrical shells, Design of simply supported circular cylindrical shells using membrane theory, Beam theory and ASCE Manual No.31

Module II (15 Hours)

Folded Plates – Introduction- Analysis using ASCE Task Committee method – Design using Beam Method

Module III (9 Hours)

Tall Buildings –Introduction, Structural Systems, Principles of design and detailing of Shear wall

Module IV (15 Hours)

Principles of design of Pre-stressed Concrete Beams –Preliminary design- flexure and shear- Introduction to limit state method as per IS - Principles of design of anchorage zones (Theory only)

Note:

1. All designs shall be done as per current I.S. specifications.
2. Special importance shall be given to detailing in designs.
3. Limit state design shall be practiced wherever possible
5. Use of I.S. codes and SP16 shall be permitted in the examination hall.

Text Books :

1. Varghese P.C., Advanced Reinforced Concrete Design , PHI
2. N. Krishnaraju, Advanced Reinforced Concrete Design, CBS Publishers.
3. Jain and Jaikrishna, Plain & Reinforced Concrete Vol. 11, Nem Chand
4. Lin.T.Y.and Burns ,Design of Prestressed Concrete Structures ,John Wiley
5. Libby , Pre stressed Concrete ,CBS Publishers
6. N. Krishnaraju, Pre stressed Concrete, Oxford & IBH
7. Roy & Sinha, Pre stressed Concrete
8. B.S. Taranath, Structural Analysis and design of Tall Buildings, McGraw Hill

Reference books:

1. Park & Paulay, Reinforced Concrete Structures
2. Krishnaraju N, Structural Design and Drawing, University Press
3. IS 2210-1962, Criteria for The Design of R.C.C. Shell Roofs & Folded Plates
4. IS 1343- Code of practice for design of pre-stressed concrete structures
5. ASCE, Manual for Design of Cylindrical Concrete Shell Roofs No. 31
6. Ramaswamy G.S., Design & Construction of Concrete Shell Roofs
7. Advanced Engineering Bulletin No. 14, Design of Combined Frames & Shear Walls, Portland Cement Association
8. Special Publication, Shear Wall Frame Interaction - A Design Aid With Commentary By McLeod I.A., Portland Cement Association

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Note: No charts, tables, codes are permitted in the Examination hall .If necessary relevant data shall be given along with the question paper by the question paper setter.

Maximum Total marks: 70

CE 09 L08: ADVANCED GEOTECHNICAL ENGINEERING I

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module 1 (13 Hours)

Clay mineralogy: Introduction-Gravitational and surface forces-Electrical charges on clay minerals-bonds-basic structural units of clay-isomorphs substitution-base exchange capacity-common clay minerals (Kaolinite, Montmorillionite and illite only)-Diffuse double layer-thixotrophy-activity of soils-capillary water – soil suction-capillary potential-capillary siphoning.

Module II (13 Hours)

Flow of water through soil: Introduction- Permeability of soil-aquifers-field methods for permeability-seepage of water –upward flow-effective stresses under steady seepage conditions-quick sand condition-failure of hydraulic structures by piping-Two dimensional flow-Laplace's equation-flow net and it's uses-construction of flownet for sheet pile wall and earth dams-phreatic lines-flow net for anisotropic soil(only basic aspects).

Module III (14 Hours)

Shear strength of soil-Introduction-Mohr-Coulomb failure criteria-modified failure envelope-total stress and effective stress analysis-stress vs. strain curves for soil-volumetric strain vs. axial strain-pore pressure vs. axial strain-critical void ratio-modified failure envelope-pore pressure parameters-choice of shear test and test conditions-liquefaction of sands-behaviour of over consolidated and normally consolidated soil during shearing-introduction to shear strength of partially saturated soil.

Module IV (14 Hours)

Earth and earth retaining structures- Introduction-Earth pressure theories-Types of retaining walls-Design of retaining walls-Gravity and cantilever retaining walls(only)-sheet pile walls-Types-Pressure distribution diagrams for cantilever and anchored sheet pile walls in cohesion less and cohesive soils-Features of earth dams(introduction only).

Reference books

1. Arora K.R., *Soil Mechanics & Foundation Engg.*, Standard Publications
2. Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications
3. Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
4. James K. Mitchell, Fundamentals of soil behavior, John Wiley and Sons, Inc.
5. Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill Publishing Compay Limited,New Delhi.
6. Terzaghi & Peck, *Soil Mechanics in Engineering Practice*, Asia Publishing
7. Murthy V.N.S., *Soil Mechanics & Foundations*
8. Coduto, *Geotechnical Engineering Principles and Practices*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Note: No charts, tables, codes are permitted in the Examination hall .If necessary relevant data shall be given along with the question paper by the question paper setter.

Maximum Total marks: 70

CE 09 L09: ADVANCED GEOTECHNICAL ENGINEERING II

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module 1 (13 hours)

Well foundations: Introduction- Applications-Different shapes of wells-grip length-scour depth-design depth-forces acting on well foundation-Terzaghi's method of analysis (only general case)-bearing capacity based on N value(only IS recommendation)-design of individual components of well-sinking of wells-measures for rectification of tilts and shifts. Features of Box(floating) caisson and pneumatic caisson.

Module II (14 hours)

Foundation on expansive soils: Introduction to expansive soil- Identification of expansive soils- shrinkage and expansion of clay- -classification of expansive soil-direct measurement of swell and swell pressure-Free swell-swelling potential-Tests for swell pressure(only IS code method)-prediction of swell pressure from index properties-classification of damages in buildings-causes and types of damages in buildings on expansive soils- Damages and cracks in buildings on expansive soils-preventive measures for expansive soils-modification of expansive soils-principles of design of foundations in expansive soil deposits-environmental solutions such as soil replacement techniques and lime columns-structural solutions such as provision of rigid foundation, under reamed piles, T Beams as strip footing for walls (only basic aspects are to be discussed)

Module III(14 hours)

Soil dynamics and Machine foundations: Introduction- Soil behavior under dynamic loads and application-Difference between static and dynamic load behavior-soil properties relevant for dynamic loading- free vibrations and forced vibrations- Types of machines-Types of machine foundations -vibration analysis of a machine foundation-general design criteria for machine foundations- Design criteria for foundation for reciprocating machines(only IS specifications)-design procedure for block foundation for a reciprocating machine-reinforcement and construction details-vibration isolation and control

Module IV(13 hours)

Stability of slope: Introduction- swedish circle method- location of most critical circle-use of N curve and T-curve-use of rectangular plot-stability of slope under steady seepage condition, sudden draw down condition and during construction- Improving stability of slopes.

Introduction to software packages in Geotechnical Engineering- for bearing capacity analysis and stability of slopes (application of a simple case on any one package)

Reference books

1.Joseph E. & Bowles, *Foundation Analysis & Design*, McGraw Hill
2.P.C.Varghese, Foundation Engineering,Prentice-Hall of India Private Ltd, New Delhi
3.Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill Publishing Compay Limited,New Delhi.
4.Leonards G.A., *Foundation Engineering*, McGraw Hill
5.Arora K.R., *Soil Mechanics & Foundation Engg.*, Standard Publications
6.Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications
7.Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
8.Teng W.C., *Foundation Design*, PHI
9.Tomlinson M.J., *Foundation Design & Construction*, Pitman
10.Coduto, *Geotechnical Engineering Principles and Practices*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Note: No charts, tables, codes are permitted in the Examination hall .If necessary relevant data shall be given along with the question paper by the question paper setter.

Maximum Total marks: 70

CE09 L10 HIGHWAY PAVEMENT DESIGN

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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

Note: IRC 37 2001 and 58-2002 and design charts are permitted for University Examinations

Module I (13 hours)

Introduction: types and component parts of pavements - factors affecting design and performance of pavements - comparison between highway and airport pavements - functions and significance of sub grade properties – various methods of assessment of sub grade soil strength for pavement design - cause and effects of variations in moisture content and temperature - depth of frost penetration - design of bituminous mixes by Marshall method

Module II (14 hours)

Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - burmister 2 layer and 3 layer theories - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi - empirical and theoretical approaches for flexible pavement design - group index, CBR, triaxial, mcleod and burmister layered system methods

Module III (14 hours)

Stresses analysis and methods of rigid pavement design: types of stresses and causes - factors influencing
stresses, general conditions in rigid pavement analysis - ESWL- wheel load stresses - warping stresses – friction stresses - combined stresses - functions of various types of joints in cement concrete pavements - design and detailing of slab thickness ; longitudinal, contraction and expansion joints by IRC recommendations

Module IV (13 hours)

Pavement evaluation: structural and functional requirements of flexible and rigid pavements - pavement distress - evaluation of pavement structural condition by Benkelman beam rebound deflection and plate load tests - introduction to design of pavement overlays
Problems of highway rehabilitation – pavement rehabilitation programming.

Text Book:

Khanna S.K. and Justo, CEG, *Highway Engineering*, NemChand and bros.

References:

1. Yoder and W Nitezak, *'Principles of Pavement Design'*, John Wiley
2. Yang, *'Design of Functional Pavements'*, McGraw Hill
3. IRC: 37 - 2001, *'Guidelines for the Design of Flexible Pavements'*
4. IRC: 58 - 2002, *'Guidelines for the Design of Rigid Pavements'*
5. David Croney, *'The Design and Performance of Road pavements'*, HMSO publications
6. Hass and Hudson, '*Pavement Management System*', McGraw Hill Book Co.
7. IRC 81-1981- '*Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques'*.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Note: IRC 37-2001 and 58-2002 and design charts are permitted for University Examinations

CE09 L 11: ECOLOGY & ENVIRONMENTAL CHEMISTRY

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction - definitions of ecology - subdivisions of ecology - approaches to the study of ecology - scope of ecology - ecology and human welfare - forestry - sericulture - horticulture and arboriculture - aquaculture fisheries and hatcheries - control of pest species - environmental conservation - conservation of natural resources - ecology in national affairs - ecology in education

Module II (13 hours)

Ecosystem - definition - principal steps and components of an ecosystem - tropic levels - food chains and food webs - energy flow in ecosystem - ecological pyramids - productivity of the ecosystem - homeostasis of the ecosystem and cybernetics - significance of ecosystem studies in developing countries - major ecosystems - definition and kinds of biogeo chemical cycles

Module III (14 hours)

Basic concepts from general chemistry - compounds - Avogadro's number - valancy, oxidation static - bonding - oxidation reactions - gas laws - solutions equilibrium and Lechatelier's principle - variation of equilibrium relationship - ways of shifting chemical equilibrium - basic concepts from physical chemistry - heat & work - energy - enthalpy - entropy - free energy - temperature dependence of equilibrium constant - vapor pressure of liquid - surface tension - binary mixture - osmosis - dialysis - principles of solvent extraction - electrochemistry - chemical kinetics - catalysis - absorption

Module IV (14 hours)

Basic concepts from organic chemistry - isomerism - aliphatic compounds - hydro carbons - alcohol - aldehydes - ketons - ester - ethers - alkyl halides - cyclic aliphatic compounds - mercaptans thioalcohols - aromatic compounds - hydrocarbons, phenols, alcohols, aldehydes, ketones, acids - hetero cyclic compounds basic concepts from colloidal chemistry - methods of formation - colloidal dispersion in liquid - colloidal dispersion in air - basic concepts from nuclear chemistry - nuclear theory - stable and radio active nuclides - atomic transmutation and artificial radio activity - nuclear reaction - nuclear fission - effects

Reference books

1. Kotpal R.L. & Bali N.P., Concepts of Ecology
2. Odum E.P., Ecology & Our Endangered Life Support Systems
3. Kudesia V.P., Environmental Chemistry
4. Sawyer, McCarty, Chemistry for Environmental Engineering, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Analytical / Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE09 L12: INDUSTRIAL STRUCTURES

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
1. To familiarize with the design of special structures widely used in industrial plants.
2. To reinforce the fundamental courses in structural design in the perspective of industrial applications.

Module 1 (13hrs)
Functional design of industrial buildings: (7 hrs)
Classification of industrial structures-layout planning requirements –Guidelines from factories act – Lighting- Illumination levels – Principles of day lighting /artificial lighting design – Natural / Mechanical ventilation – Fire safety requirements – Corrosion protection – Protection against noise – Cladding systems- vibration isolation techniques - Industrial floors.
Introduction to diverse types of industrial structures: (6 hrs)
General overview of Thermal power plant/Nuclear power plant structures / Process plant steelwork – conveyor structures – Boiler supporting structures-Substation structures.

Module 2 (13 hrs)
Structural Design of Industrial Buildings:
Braced Industrial buildings – Unbraced Industrial frames – Gantry girders –Design of steel beam connections-Flexible & Rigid (Bolted and welded types)

Module 3 (14 hrs)
Special Industrial Structures:
Machine foundations – Types-Design Requirements-Analysis and design of block type machine foundations (IS 2974 method)
Design of Reinforced concrete bunkers and silos as per IS:4995
Tall Chimneys (RCC) –Types-Chimney sizing parameters- Overview of wind and temperature effects-Design principles of Reinforced concrete chimneys as per IS: 4998.

Module 4 (14 hrs)
Tower Structures:
Cooling Towers –Types and functions- Design principles of RC natural draught cooling towers as per IS: 11504
Transmission line Towers- Types-Design loadings-Analysis and design concepts- Description of TL tower foundations.

Textbooks:
1. Proceedings of an advanced course on industrial structures, SERC – 1982.
2. S.N.Manohar, Tall Chimneys-Design and Construction, Tata Mc Graw Hill.
3. P.Dayaratnam, Design of steel structures, Wheeler Publishing Co.
4. Ramchandra, Design of steel structures, Vol. 1 and 2, Standard Book house Delhi.
5. Srivasulu and Vaidyanathan, Handbook of machine foundations-Tata McGraw Hill.
6. Murthy and Santhakumar, Transmission Line structures, McGraw Hill

References:

1. SP: 32–1986,Hand book on functional requirements of Industrial buildings (Lighting and ventilation).
2. G.W.Owens, P.R.Knowles and P.J.Dowling- Steel Designers' manual – 5th edition – Blackwell scientific publications.
3. V.Kalayanaraman, Advances in steel structures. Tata McGraw Hill
4. Krishnaraju N., Advanced Reinforced concrete design, CBS Publishers.
5. K.K.Mc Kelvey and Maxey Brooke, The Industrial Cooling Tower, Elsevier Publishing Co.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Analytical / Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE09 L13: STRUCTURAL DYNAMICS AND SEISMIC DESIGN

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

To equip students with the basic knowledge on design of earthquake resistant structures

Module I (11 hours)

Overview of structural dynamics – Fundamental objective of structural dynamic analysis – types of prescribed loadings – essential characteristics of a dynamic problem – method of discretization, lumped mass procedure – generalized displacements – Single degree of freedom system – Components of the basic dynamic system – formulation of the equation of motion – D Alembert's principle - influence of gravitational forces - generalized SDOF system- Rigid body assemblage - expression for generalized system properties.

Module II (14 hours)

Solution of the equation of motion- undamped free vibration- damped free vibration- critical damping- under damped system- over damped system- negative damping-concept of Coulomb damping.

Response to harmonic loading - Undamped system- complementary solutions- particular solution- general solution- response ratio – Viscously damped system- resonant response- dynamic amplification factor- vibration isolation.

Response to periodic loading - Fourier series expression of the loading- Response to the Fourier series loading - Exponential form of Fourier series solutions – concept of four way logarithmic graph paper

Module III (15 hours)

Base-excited SDOF system - formulation of basic equation– concepts of pseudo acceleration, velocity and displacement - Earthquake response spectra (concept only).

Lumped mass modelling of multi-storey shear building and modes of vibration (concepts only-demonstration with example- students are not expected to solve during examination)

Performance of building and structures under earthquakes- Main Causes of Damage- Intensity of earth quake forces, lack of strength and integrity of buildings, quasi resonance – lack of ductility, lack of detailing.

Earth quake effects- On buildings, structures, power plants, switch yards, equipments or other life line structures, soil liquefaction- Assessment of damage

Philosophy and Principles of earthquake.-resistant design- Strength and stiffness- ductility-based design and detailing, concepts of seismic isolation and seismic active control, Building forms and architectural design concepts- Horizontal and vertical eccentricities due to mass and stiffness distribution (Numerical exercises not expected) IS specifications.

Module IV (14 hours)

Equivalent Static Method- Seismic zones and coefficients – response reduction factors -Estimations of fundamental time period, base shear and its distributions using IS: 1893 for multistory buildings (regular shape only).

Use of codes like IS: 4326, IS: 13828, IS: 13827, IS13920, SP:22 with reference to masonry, RCC and steel building Detailing of reinforcement and joints.

Restoration and retrofitting - Methodologies for restoration and retrofitting – For walls, roofs, slabs, columns and foundation of building in stones, brick or reinforced concrete structures

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Text books

1. Anil K Chopra, Dynamics of structures-theory and applications to earthquake engineering, Pearson Education
2. R W Clough and J Penzien, Dynamics of structures, McGraw Hill
3. Jaykrishna, Elements of earthquake engineering, Saritha Prakasan, Naunchandi, Meerut.

References

1. Pillai & Menon, Reinforced concrete design, Tata McGrawHill
2. Park & Paulay, Reinforced concrete, McGrawHill
3. Madhujit Mukhopadhyay, Structural Dynamics – Vibrations and System, Ane Books India

IS Codes:

4. IS:1893 - (Part I), Criteria for Earthquake Resistant structures-General Provisions and Buildings
5. IS:13935 – Repair and Seismic strengthening of buildings
6. IS:4326 - Earthquake Resistant Design and Constructions of buildings
7. IS:13827 – Improving Earthquake Resistance of Earthen buildings
8. IS:13828 - Improving Earthquake Resistance of Low strength Masonry buildings
9. IS:13920 – Ductile detailing of RC Structures subject to Seismic forces.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Analytical / Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE 09 L14: SOIL EXPLORATION, TESTING AND EVALUATION

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective

- To equip students with techniques of exploration, testing and evaluation for soil parameters required for foundation choice and design

Module I (14 hours)
Soil Exploration: objectives-methods-depth, spacing, size and number of boreholes-different methods of boring-bore logs-sample requirements-sampling methods and equipments-handling, preservation and transporting of samples-rock core recovery-rock quality designation-geophysical and seismic methods-preparation of soil investigation reports(Students are expected to know how to choose type of exploration for different type of works, how to carry out the exploration and must be able to prepare soil investigation reports)

Module II (14 hours)
Laboratory Testing of Soil: water content, specific gravity, grain size analysis, Atterberg's limits and indices, Permeability: constant head and variable heads, Compaction: light and heavy, Consolidation: time-settlement, e-log(p) curve- pre-consolidation pressure-Shear Test: direct shear, triaxial, unconfined compression, vane shear –pore pressure measurement
(Students are expected to know the test procedures, computations o properties from observations and correlations and interpretation of results. Theoretical treatment – derivation etc is not required)

Module III (12 hours)
Field Testing of Soil: Plate load test, standard penetration test, static cone penetration test, Dynamic cone penetration test, Pressure meter test, Field Vane shear test, Field permeability test
(Students are expected to know the test procedures, computations o properties from observations and correlations and interpretation of results. Theoretical treatment – derivation etc is not required)

Module IV (14 hours)
Laboratory and Field Testing of Rocks: Laboratory tests: Tension, shear and flexure tests – Elastic Modulus by Brazilian and bending tests.
Insitu tests: Test for deformability, shear tests, strength tests and test for internal stresses.

Text Books
1. Alarm Sing, Soil Engineering- Theory and Practice, Asia Pub

Reference Books
1. Lambe, Soil Testing for Engineers, John Wiley, NewYork
2. Goodman R.E., Rock Mechanics, John Wiley, NewYork
3. Terzaghi, K. and Peek R.B., Soil Mechanics in Engineering Practice, John Wiley
4. Murthy V.N.S., Soil Mechanics anfd Foundation Engineering, DhanpathRai
5. Coduto, Geotechnical Engineering Principlres and Practices, Pearson Education
6. Joseph E., and Bowls, Foundation Analysis and Design, McGraw Hill
7. Tomlinson M J., Foundation Design and Construction, Pitman

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Analytical / Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE09 L15: SURFACE HYDROLOGY AND WATER POWER

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

To make the students aware of the importance of surface water resources and strategic back ground information for its effective and wise utilization

Module I (14 Hours)

Introduction: Hydrologic cycle- application of hydrology in engineering – water balance equation – water resources of India – review of rainfall measurement and analysis.

Abstraction from precipitation: Evaporation – measurement, estimation and control of evapo-transporation (ET) – estimation of evapo-transpiration – evapo-transpiration and consumptive use – measurement of ET – lysimeters and field pots – potential ET and its computation – pav evaporation- Pennman's method – Blaney Criddle method – reference crop ET and crop coefficient – interception and depression storage – infiltration processes – measurement using infiltrometers – infiltration capacity – infiltration indices – Hortan's model of infiltration.

Rain water harvesting – water scarcity in Kerala – reasons – manmade alterations in hydrologic cycle – methods of water conservation

Module II (13 Hours)

Characteristics of run off – factors affecting run off – components of hydrograph – base flow separation – rain fall – run off relations – unit hydrograph theory – derivation of unit hydrograph – applications and limitations of unit hydrograph- S hydrograph – instantaneous unit hydrograph – unit hydrograph for ungauged catchments – synthetic hydrograph – conceptual elements – linear reservoirs – Nash model. Yield from a catchment – flow duration curves – flow mass curve.

Module III (13 Hours)

Floods – estimation of peak discharge – rational method- unit hydrograph method. Probabilistic and statistical methods – basic concept of probability and frequency distribution – skewness coefficient – return period discrete distribution – Binomial distribution – continuous distribution – flood frequency analysis – normal, lognormal, Gumbel and Log-Pearson Type III methods.

Flood routing – reservoir routing – Modified pulse method – channel routing – Muskinghum method.

Module IV (14 Hours)

Water power – types of hydro power schemes – runoff river plant- pumped storage plant – tidal power plants – hydro power potentials of India – economic considerations of water power – estimates of available water power – gross and net head – available power – power duration curve – assessment of water power potential - load factor, capacity factor, utilization factor- general layout of hydro power scheme – elements of hydro power scheme – intakes -functions – types – tail race, Penstocks – location – types – economical diameter- penstock accessories – anchor block – water hammer – water hammer equation – Cavitations – Surge Tanks – functions and types – turbines – review of basics – characteristic curves – draft tubes – governing of turbines.

Text books:

Subramanian K., Engineering Hydrology, Tata McGraw Hill

Reghunath H.M., Hydrology, Prentice Hall

Duggel K.N., and J.P. Soni, Elements of water resources engineering, New Age International Publishers.

References:

Chow V.T., Dr.Maidment and L.W. May, Applied hydrology, McGraw Hill Book Co., Singaopre 1988
McCuen R.H, Hydrologic analysis and design, Prentice Hall
Singh V.P., Elementary Hydrology, Prentice Hall of India
Veissman, W. Jr., G L Lewis and J W. Knapp, Introduction to hydrology, Harper and Row, NewYork
Rao K. L., Water resources of India,

CE09 L16 URBAN TRANSPORTATION PLANNING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
To equip the students with the basic principles of transportation planning.

Module I (14 hours)
Urban transportation planning process and concepts: Role of transportation - transportation problems – urban travel characteristics - evolution of transportation planning process - concept of travel demand - demand function - independent variables - travel attributes - assumptions in demand estimation - sequential, recursive and simultaneous process

Module II (13 hours)
Trip generation analysis**:** Definition of study area - zoning - types and sources of data - road side interviews - home interview surveys - expansion factors - accuracy checks. Trip generation models - zonal models – category analysis - household models - trip attractions of work centres

Module III (13 hours)
Trip distribution analysis**:** trip distribution models - growth factor models - gravity models - opportunity models

Module IV (14 hours)
Mode split and route split analysis**:** mode split analysis - mode choice behaviour - competing modes - mode split curves - probabilistic models - route split analysis - elements of transportation networks - coding - minimum path trees - all-or-nothing assignment - capacity restrained assignment

Text book
1 Khanna.S.K and Justo.C.E.G., Highway Engineering, Nemchand and Bros.
2 Kadiyali.L.R., Traffic Engineering and Transportation planning, Khanna Publishers, New Delhi.

References books
1. Hutchinson B.G., *Principles of Urban Transportation System Planning*, McGraw Hill
2. Khisty C.J., *Transportation Engineering - An Introduction*, Prentice Hall
3. Bruton M.J., *Introduction to Transportation Planning*, Hutchinson of London.
4. Papacostar, *Fundamentals of Transportation Planning*, Tata McGraw Hill
5. Dicky J.W., *Metropolitan Transportation Planning*, Tata McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Maximum Total marks: 70

CE 09 L 17: ARCHITECTURE AND TOWN PLANNING

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
The objective of this subject is to study the principles of architecture design and functional planning of buildings. The topic town planning helps to realise the process of resource mobilization, organization of landuse, transportation and infrastructure networks both for efficient functioning and creation of pleasant and well ordered environment.

Module I (14 hours)
Principles of architectural design – definition of architecture – factors influencing architectural development – characteristics features of style – historic examples – creative principles.
Principles of architectural composition – Unity – balance – proportion – scale –rhythm – harmony – Accentuation and contrast.
Organising principles in architecture – Symmetry – hierarchy – axis – linear – concentric, radial – and asymmetric grouping – primary and secondary masses.
Role of colour, texture, shapes/ forms in architecture.
Architectural space and mass, visual and emotional effects of geometric forms, space activity and tolerance space. Forms related to materials and structural systems.
Elements of architecture : Functions – Pragmatic utility, circulatory function, symbolic function, Physiological function. Structure – Physical structure, Perceptual structure. Space in architecture – Positive and negative space. Aesthetics: Visual perception. Protective: Protection from climate and other elements, architecture a part of the environment. Comfort factors.

Module II (13 hours)
Functional planning of buildings - occupancy classification of buildings - general requirements of site and building codes and rules - licensing of building works - the process of identifying activity areas and linkages – Design concepts and philosophies - checking for circulation, ventilation, structural requirements and other constraints - preparing sketch plans and working drawings - site plans - presentation techniques - pictorial drawings - perspective and rendering - model making - introduction to computer aided design and drafting

Module III (14 hours)
Town planning theory - evolution of towns - problems of urban growth - beginning of town planning acts - ideal towns - garden city movement - concept of new towns and conservative surgery - comprehensive planning of towns - survey and analysis of town - base maps - land use classification - transportation network – housing, demographic, socio - economic studies - Environmental aspects - theories of land use planning, transportation planning and housing development - urban area delineation - urban influence zone - urban region - concepts of regional planning

Module IV (13 hours)
Concepts of master plan, structure plan, detailed town planning scheme and action plan, estimating future needs - planning standards for different land use, allocation for commerce, industries, public amenities, open areas etc. - planning standards for density distributions - density zones - planning standards for traffic network - standard of roads and paths - provision for urban growth - growth models - plan implementation - town planning legislation and municipal acts - panning of control development schemes - urban financing - land acquisition - slum clearance schemes - pollution control aspects

Text Books:

1. Satish Chandra agarwala, Architecture and Town Planning, Dhanpat Rai & Co.
2. Gurucharan Singh and Jagdish Singh, Building Planning and Scheduling, Standard Publishers and Distributers.
3. S.C Rangwala, Town Planning, Charotar Publishing House.

Reference books:

1. Banister Fletcher, A History of World Architecture
2. Pency Brown, Indian Architecture - Vols I & II., D.B. Taraporevala Son's & co.
3. Scot, Design Fundamentals, McGraw Hill
4. Hazel Convay & Rowen Roenisch , Understanding Architecture.
5. Lewis Keeble, Principles and practice of Town and Country Planning.
6. Peter Hall, Urban & Regional Planning.
7. Peter Hall, Urban Future 21.
8. Broadbent, Theory of Architectural Design
9. Gallion, Urban Pattern, CBS
10. Lewis H.M., Planning the Modern City, John Wiely
11. Rame Gouda, Principles & Practices of Town Planning, University of Mysore, Manasa Gangotri

CE 09 L 18: ADVANCED CONSTRUCTION ENGINEERING & MANAGEMENT

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

To familiarise students with advanced construction methods and management techniques usually adopted in large projects

Module-I (11 hours)

Construction projects- project development process - project management - main causes of project failure.

Equipment intensive operations and risks - equipment types - selection of equipment–owning and operating cost of equipment - economic life of equipment – depreciation – replacement decisions.

Module – II (15 hours)

Earthwork construction: planning – graphical presentation – earthwork quantities – mass diagram and its use- properties of geotechnical materials – bank, loose and compacted measures - compaction specification and control – soil processing – compaction methods and equipment – stabilisation methods.

Flexible pavement construction : structure and materials – asphalt plants – batch plants, drum mix plants, dust collectors, asphalt storage and heating, reclaiming – paving equipment – sweeper, haul trucks, asphalt distributors and pavers – compaction equipment. Pavement laying methods – paving practice, laying width, surface dressing, repaving.

Module – III (15 hours)

Concrete production and placement**:** Significance of proportioning concrete mixtures – use of mineral admixtures in concrete – significance and applications of light weight concrete, high density concrete, polymer concrete composites, fibre reinforced concrete, high performance concrete, vacuum concrete.

Handling and batching concrete materials - mixing - types of mixers – Ready mixed concrete – transporting and placing methods – equipment for consolidation of concrete – finishing and curing methods – slipform paving - roller compacted concrete – Hot weather and cold weather concreting – under water concreting – shotcreting.

Module –IV (13 hours)

Project control methodology – control system framework – parameters to be controlled – performance base lines – performance accounting process – monitoring performance – information communication – control benefits.

Quality management - importance of quality - elements of quality - organisation for quality control - quality assurance techniques – documentation - quality control circles - total quality management - ISO 9000.

Text Books

1. R.L.Peurifoy and Schexnayder – Construction Planning, Equipment, and Methods, 6th Edition, Tata McGraw Hill
2. Chitkara, K.K. - Construction Project Management - Planning, Scheduling and Controlling, Tata McGraw Hill Publishing Co., New Delhi.

References books

1. Neville A.M. and Brooks.J.J. - Concrete Technology, Pearson Education.
2. Banga, Sharma, Agarwal. – Industrial Engineering and Management Science, Khanna Publishers.
3. F. Harris - Modern Construction and Ground Engineering Equipment and Methods, Prentice Hall.
4. Jagman Singh – Heavy Construction – Planning, Equipment an Methods, Oxford & IBH Publishing Co.
5. James E. Russell, Construction Equipment, Reston Publishing Company, Inc., Virginia.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Maximum Total marks: 70

CE09 L19: COASTAL ENGINEERING AND MARINE STRUCTURES

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective
To develop basic knowledge on Ocean Engineering and related applications.

Module I (16 Hours)
Introduction: man-ocean interaction-effects of ocean on ecology and climate-ocean as a source of food and means of communication-minerals in ocean-ocean for disposal of wastes- integrated coastal zone management (ICZM) and its importance in India.
Theory of ocean waves: formulation of wave motion problem-assumptions made in two dimensional cases-small amplitude wave theory-orbital motions and pressures-problems-wave energy.

Module II (10 Hours)
Brief introduction to finite amplitude wave theories-mass transport-: Gerstner theory-Stokes theory, solitary wave theory-relationships among wave dimensions-wind and fetches-generation of waves-wave forecasting- S.M.B and P.N.J methods-problems

Module III (14 Hours)
Reflection, refraction and diffraction of waves: clapotis or standing waves-super position of waves-diffraction of waves around semi infinite break waters –detached breakwater of finite length-diffraction through openings. Wave forces on structures: forces on vertical walls due to non-breaking waves, breaking waves and broken waves based on linear theory-Forces on fixed vertical circular cylinder in the Morison regime- problems Introduction to Froude-Krylov force and Diffraction regime--Tsunami: Generation, propagation-warning systems.

Module IV (14 Hours)
Shores and Shore processes: long term and short term changes of shores –factors influencing beach characteristics-beach wave interaction-beach profile modification-littoral drift-stability of shores-shore erosion due to sea level rise-on shore and off shore transport-long shore transport-interaction of shore structures-shore erosion in Kerala-mud banks
Shore Protection works: description and effects of break waters-sea walls-groynes of various types-beach nourishment, break waters, tetrapod, tribar etc. Hudson’s formula and simple design problem.

Text Books:
Ippen A.T, R, Estuary and Coastline Hydrodynamics
.Sarpkaya, T.,Isaacson,M., Mechanics of Wave Forces on Offshore Structures, Van Nostrand Renhold Company

Reference Books:

1 Chakrabarti,S.K., Hydrodynamics of Offshore structures, Computational Mechanics Publications, Southampton, Boston
2. Wiegel R.L, Oceanographical Engineering, Prentice Hall.
3. Coastal Engineering Manual (CEM-Department of the Army-US Army Corps of Engineers-2001 or latest revision)

Internal assessment: Maximum marks:30

60% - Tests (Minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term project, software exercise etc.
10% - Regularity in the class

University examination pattern:

PART A : Short answer questions 5x2 marks=10 Marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: Analytical / Problem solving questions 4x5 marks=20 Marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: Descriptive/Analytical / Problem solving questions.4x10 marks= 40 Marks
Two questions from each module with choice to answer one question.
Maximum Total marks:70

CE09 L20: GROUND WATER HYDROLOGY

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

- To make the students aware of the importance of groundwater resources and to impart strategic background information for its effective and wise utilisation

Module I (14 hours)
Occurrence of ground water: origin - rock properties affecting ground water vertical distribution - geologic formations as aquifers -types of aquifers - aquifer parameters-ground water basins - springs - Laplace equation - potential flow lines - flow net – flownet for anisotropic soils- seepage under a dam -groundwater contours- determination of flow direction- steady unidirectional flows in aquifers- confined and unconfined -aquifer with percolation- steady radial flow towards a well- well in uniform flow - steady flow with uniform discharge- partially penetrating wells- steady flow in leaky aquifer.

Module II (13 hours)
Unsteady flow-general equation- Cartesian and polar coordinate- unsteady radial flow in to a well - confined, unconfined and leaky aquifers -–multiple well system - pumping tests - non equilibrium equation for pumping tests - Thies' method - Jacob method - Chow's method -characteristics well losses –step draw down test- well near aquifer boundaries -determination of boundaries from pumping test .Image wells. for various boundary conditions-
Cavity well and open well- yield tests-pumping and recuperation test.

Module III (14 hours)
Tube wells: design - screened wells - gravel packed wells - well loss-selection of screen size - yield of a well - test holes - well logs - methods of construction - dug wells -shallow tube wells - deep wells - gravity wells - drilling in rocks - screen installation - well completion - well development - testing wells for yield - collector - or radial wells - infiltration galleries - well point system - failure of tube wells

Module 1V (13 hours)
Quality of ground water: ground water samples - measurement of water quality- chemical, physical and bacterial analysis - quality for domestic use - quality for agricultural use - pumps - shallow well pumps - ground water investigation - geographical investigation - electrical resistivity method - seismic refraction method - gravity and magnetic method - test drilling - resistivity logging - potential logging - artificial recharge - recharge by water spreading – sewage recharge - recharge through pits, shafts and wells-rain water harvesting

Text Book
Raghunath H. M., Ground water Hydrology, Wiley

Reference books:
1. Todd D.K., Ground Water Hydrology, John Wiley
2. Garg S.P., Ground Water & Tube wells, Oxford & IBH
3. Raghunath H.M., Hydrology, Wiely Eastern

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Analytical / Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE 09 L21 GROUND IMPROVEMENT TECHNIQUES

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module I (15 hours)

Objective of ground improvement-In-situ ground improvement methods-Introduction to soil improvements without the addition of many material - surface compaction –compaction piles in sand-

impact compaction/dynamic compaction of sands – vibratory compaction in sand-vibroflotation in sand–explosions in sand- Terra probe method- replacement process - vibroflotation in clays-- preloading techniques- sand drains-stone columns-introduction to soil improvement by thermal treatment- introduction to bio technical stabilization

Module II (13 hours)

Introduction to soil improvement by adding materials - lime stabilization –Mechanism-optimum lime content-lime fixation point-effect of lime on physical and engineering properties of soil- lime column method - stabilization of soft clay or silt with lime – stabilization with cement-suitability for soils-effect on properties of soils

Groting-types-desirable characteristics of grouts-grouting methods-grouting pressure-grouting materials - grouting technology- permeation grouting- compaction grouting- soil fracture grouting-jet grouting -- application and limitations - slab jacking, grouted columns-application to dams.

Module III (12 hours)

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development - soil types-reinforcing materials - Reinforced earth retaining walls- reinforced embankments-soil nailing -improvement using natural materials (introduction only).

Module IV (14 hours)

Geosynthetics–Types-applications (only general applications)- types of geotextiles and geo grids - physical and strength properties of geotextiles and geogrids - behaviour of soils on reinforcing with geotextiles and geogrids- - design aspects with geotextiles and geogrid for clay embankments, retaining walls and unpaved roads.

Reference books:

1.Moseley, *Text Book on Ground Improvement*, Blackie Academic Professional, Chapman & Hall

2.Purushotham S. Raju, *Ground Improvement Technique*, Laxmi Publications

3.Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill Publishing Compay Limited,New Delhi.

4.Boweven R., *Text Book on Grouting in Engineering Practice*, Applied Science Publishers Ltd

5.Jewell R.A., *Text Book on Soil Reinforcement with Geotextiles*, CIRIA Special Publication, Thomas Telford

6.Donald .H. Gray & Robbin B. Sotir, *Text Book On Bio Technical & Soil Engineering Slope Stabilization*, John Wiley

7.Rao G.V. & Rao G.V.S., *Text Book On Engineering With Geotextiles*, Tata McGraw Hill

8.Korener, *Construction & Geotechnical Methods In Foundation Engineering*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Maximum Total marks: 70

CE09 L22: ENVIRONMENTAL POLLUTION CONTROL ENGINEERING*

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

- To provide students with balanced information regarding different elements of pollution and its control measures
- To make students aware of statutory controls for pollution control.

Module I (14 Hours)

Environmental pollution – interrelationship between various forms of pollution – surface water pollution surveys – integrated river basin water management – restoration of water bodies – water quality parameters and optimization of treatment – water quality changes by domestic use – radioactive materials – thermal pollution and underground disposal – types of water pollutants and their effects – instrumentation for water quality and treatment – role of wastewater treatment as pollution control measure.

Module II (13 Hours)

Air pollution control strategy – basic approaches – areas of legal responsibility – source identification – particulate control and control of gases and vapours – factors affecting control approach selection – air pollution control technology – settling chambers – filters – electrostatic precipitators – wet scrubbers – entrainment separators – gas adsorption, gas absorption and combustion.

Module III (14 Hours)

Land pollution – pollution cycle – ecological factors in plant site selection – ecological aspects of vegetation control – noise pollution – the physics of sound and hearing – effects of noise – sources – instruments and techniques for noise measurements – light and glare pollution – light and its characteristics - glare – outdoor lighting and glare sources – corrective procedures.

Module IV (13 Hours)

Environmental impact analysis – physical, social, aesthetic and economic assessment of highway project, mining and power plants – legislative control – water pollution laws and regulations – Air pollution control act of India – chimney heights – land pollution laws and regulations.

Reference Books:

1. Rao C S, Environmental Pollution Control Engineering, New Age International (P) Ltd.
2. Goel P K, Water Pollution Causes, Effects and Control, New age International (P) Ltd.
3. Birdie G.S & Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons.
4. Bethea R.M, Air Pollution Control technology, Van Nostrand Reinhold Co.
5. Flintoff F, Management of solid waste in developing countries, WHO.
6. Liptek Bela G & Bouis P.A., Environmental Engineers Handbook Vols I, II, III, Chilton Book Company.
7. Water Pollution Act (1974) passed by Govt. of India.
8. Air pollution Control act of India.
9. Relevant Indian Standards & factory Acts.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Analytical / Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.
Maximum Total marks: 70

CE09 L23: EXPERIMENTAL STRESS ANALYSIS*

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective
To make students aware of various measurement techniques and experimental planning and procedures adopted in laboratory

Module I (14 hours)
Strain gauges - definition of gauge length - sensitivity and range - characteristics of an ideal strain gauge - different types of mechanical strain gauges, optical strain gauge - acoustic strain gauge - pneumatic strain gauge - merits and demerits - electrical strain gauges - inductance, capacitance and piezo electric gauges - bonded and unbonded resistance gauges and their application in stress analysis - fixing techniques and measurement of strains - rosettes - determination of principal stress - construction of stress, strain circles - analytical solution

Module II (13 hours)
Photo elasticity - basics of optics, stress optic law - plane and circularly polarized light and their use in photos elasticity - polariscopes - diffusion type - lens type polariscopes - isoclinics and isochromatics

Module III (14 hours)
Model materials - calibration methods for finding material fringe values - model fringe values - examples of beam flexure and diametrically loaded circular plates.
Non Destructive Testing Methods – Ultrasonic Methods – Hardness methods – Rebound Hammer – Detection of embedded reinforcement.
Computer based data acquisition systems.

Module IV (13 hours)
Model analysis - direct and indirect models - laws of structural similitude - choice of scales - limitation of model studies - buckingham pi-theorem - dimensional analysis - model materials - Begg's deformater and its use - simple design of direct and indirect models

Text Books
1. Dally, J. W. and Raliey W.F., Experimental Stress Analysis, McGraw Hill.
2. Srinath L.S., Experimental Stress Analysis, Tata McGraw Hill
3. Roy, T.K., Experimental Analysis of stress and strain

Reference Books
1. Dove and Adams, Experimental Stress Analysis and Motion measurement, Prentice Hall
2. Hetenyi M., Hand book of Experimental Stress Analysis, John Wiley
3. Bently JP – Principles of Measurement Systems, Longman, 1983
4. Nakra & Chowdhary – Instrumentation Measurement & Analysis – Tata McGraw Hill, 1995

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern
PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Maximum Total marks: 70

CE09 L24: REMOTE SENSING AND GIS*

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

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

Module I (14 Hours)

Remote sensing: definition – components of remote sensing- energy sensor, interacting body – active and passive remote sensing – platforms – arial and space platforms – balloons ,helicopters, aircrafts and satellites – synoptivity and repeativity – electromagnetic radiation (EMR) – EMR spectrum – visible, infrared (IR) near IR, middle IR, thermal IR and microwave – black body radiation – Plancks Law – Stefan –Boltzman law.

Atmospheric characteristics – scattering of EMR – Raliegh, Mie, Non-selective and Raman scattering – EMR interaction with water vapur 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 II (14 Hours)

Opticaa 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 satellites – satellite sensors – resolution – spectral, spatial, radiometric and temporal resolution – description of multi-spectral scanning – along and across track scanners-description of sensors in IRS series – current satellites – radar – speckle – back scattering-side looking air borne radar – synthetic aperture radar – radiometer radar – geometrical characteristics. Principles of thermal remote sensing. Principles of microwave remote sensing.

Module III (13 Hours)

Geographic information system – components of GIS – hardware, software and organisational context – data – spatial and non spatial maps – types of maps – projection- types of projection – data input- digitiser, 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 IV (13 Hours)

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.

Text books:

1. Anji Reddy, Remote sensing and Geographical systems, BS Publications
2. M G Srinivas (Edited by), remote sensing applications, Nerusa publishing house
3. Lillesand T M and Kuefer R W., Remote sensing and image interpretation, John Wiley and sons
4. Jensan J R, Introductory digital image processing, Prentice Hall of India
5. Sabins, Flyod, F., Remote sensing principles and Interpretation, W H Freman and Co., NewYork

References:

1. Janza F J, Blue H M and Johnston, J E., Manual of remote sensing vol. I., American Society of Photogrammetry, 1975
2. Burrough P A., Principles of GIS for land resource assessment, Oxford
3. Star Jeffrey L (Ed), Ests Joh E and McGwire Kenneth, Integration of geographical systems and remote sensing, Cambridge university.
4. De Merse, Michael N., Fundamentals of geographic information system, 2nd edn., John Wiley and sons.

CE09 L25: FINITE ELEMENT METHODS*

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
To make the back ground, basic concepts and basic formulation of finite element method clear to the students

Module I (14 hours)
Introduction to Finite Element Methods: Physical problems, mathematical models and finite element solutions – Mathematical model of Discrete systems – elements and assemblage - matrix formulation – Equations of equilibrium - element assembly and solution for unknowns –Gauss elimination method, LDL^{-T} Method - Basic equations of elasticity – stress–strain and strain-displacement relations - theory of stress and deformation - stress-strain-temperature relations
Review of direct stiffness method: Descretization – element and structure stiffness matrices DOF relationship- assembly of global stiffness matrix and load vector - solution of equations for unknowns - displacement boundary conditions - computation of stress - support reactions.

Module II (13 hours)
Continuous systems: Practical Examples –mathematical models- differential formulation – limitations – Variational formulation – Total potential energy - principle of stationary potential energy - problems having many d.o.f - potential energy of an elastic body - the Rayleigh-Ritz method - piecewise polynomial field - finite element form of Rayleigh-Ritz method - finite element formulations derived from a functional - interpolation - shape functions for C^0 and C^1 elements - Lagrangian interpolation functions for two and three dimensional elements

Module III (13 hours)
Displacement based elements for structural mechanics: formulas for element stiffness matrix and load vector - overview of element stiffness matrices - consistent element nodal vector - equilibrium and compatibility in the solution - convergence requirements - patch test - stress calculation - other formulation methods
Straight sided triangles and tetrahedral: natural coordinates for lines - triangles and tetrahedral - interpolation fields for plane triangles - linear and quadratic triangle - quadratic tetrahedron
Module IV (14 hours)
The isoparametric formulation: introduction - an isoparametric bar element - plane bilinear element - summary of gauss quadrature - quadratic plane elements - direct construction of shape functions for transition elements - triangular isoparametric elements - consistent element nodal loads - validity of isoparametric elements - appropriate order of quadrature - element and mesh instabilities - remarks on stress computation
Coordinate transformation: transformation of vectors - transformation of stress, strain and material properties - transformation of stiffness matrices - transformation of flexibility to stiffness - inclined support - joining dissimilar elements to one another- rigid links - rigid elements

Text books:
1. Bathe K.J., Finite Element Procedures in Engineering Analysis, Prentice Hall of India
2. Cook R.D., Malkus D.S. & Plesha M.F., Concepts & Applications of Finite Element Analysis, John Wiley
3. Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill, 2006.

Reference books:

1. Desai C.S., Elementary Finite Element Method, Prentice Hall of India
2. Chandrupatla T.R. & Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India
3. Cook, R.D., Finite Element Modelling for Structural Analysis, John Wiley and sons.
4. Gallaghar R.H., Finite Element Analysis: Fundamentals, Prentice Hall Inc.
5. Rajasekaran S., Finite Element Analysis in Engineering Design, Wheeler Pub.
6. Krishnamoorthy C. S., Finite Element Analysis - Theory and Programming, Tata McGraw Hill
7. Zienkiewics O.C. & Taylor R.L., The Finite Element Method, Vol I & II, McGraw Hill
8. Segrelind., The Finite Element Method.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination pattern

PART A: *Short answer questions 5×2 marks=10 Marks*
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
PART B: *Analytical / Problem solving questions 4×5 marks=20 Marks*
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.
PART C: *Problem solving questions.4×10 marks= 40 Marks*
Two questions from each module with choice to answer one question.

Maximum Total marks: 70

GLOBAL ELECTIVES from Other Branches

CS09 L24 : Computer Based Numerical Methods

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of mathematical modelling 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 (13 hours)
Errors in numerical computation - mathematical preliminaries - errors and their analysis - machine computations - computer software. Algebraic and Transcendental Equations - bisection method - iteration method - method of false position - rate of convergence - method for complex root - Muller's method - quotient difference method - Newton-Raphson method.

Module II (13 hours)
Interpolation – introduction - errors in polynomial interpolation - finite differences - decision of errors - Newton's formula for interpolation. Gauss, Sterling, Bessel's, Everett's Formula - interpolation by unevenly spaced points - Lagrange interpolation formula - divided difference - Newton's general interpolation formula.

Module III (13 hours)
Numerical Integration and Differentiation – introduction - numerical differentiation - numerical integration - trapezoidal rule - Simpson 1/3 rule - Simpson 3/8 rule - Boole's and Weddle's rules - Euler-Maclariaun formula - Gaussian formula - numerical evaluation of singular integrals.

Module IV (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 and nonlinear regression - multiple regression - statistical quality control methods.

Text Books

1. E. Balagurusamy, *Numerical Methods*, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
2. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis, 6th Ed.*, Pearson Education Asia, New Delhi, 2002.

Reference Books

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, *Numerical Methods*, S.Chand Co. Ltd., New Delhi, 2003.
2. R.L. Burden and T.D. Faires, *Numerical Analysis, 7th Ed*., Thomson Asia Pvt. Ltd., Singapore, 2002.
3. Shastri, *Introductory methods of numerical analysis*, Prentice Hall International.
4. V. Rajaraman, *Introduction to Numerical Methods*, Tata McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PE09 L24: Industrial Psychology

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give awareness on the Human and Industrial Psychology*

Module I (14 hours)

Introduction- psychology as a science- area of applications – study of individual- individual differences- study of behaviour- stimulus- response behaviour- heredity and environment- human mind- cognition- character- thinking- attention- memory- emotion- traits- attitude- personality

Module II (14 hours)

Organizational behaviour- definition –development- fundamental concept- nature of people- nature of organization – an organizational behaviour system- models- autocratic model- hybrid model- understanding a social-system social culture- managing communication- downward, upward and other forms of communication

Module III 13 hours)

Motivation- motivation driver- human needs- behavior modification- goal setting- expectancy model- comparison models- interpreting motivational models- leadership- path goal model- style – contingency approach

Module IV (13 hours)

Special topics in industrial psychology- managing group in organization- group and inter group dynamics- managing change and organizational development- nature planned change- resistance- characteristic of OD-OD process

Text Books

1. Davis K. & Newstrom J.W., *Human Behaviour at work*, Mcgraw Hill International

Reference Books

1. Schermerhorn J.R.Jr., Hunt J.G &Osborn R.N., *Managing Organizational Behaviour*, John Wiley
2. Luthans, *Organizational Behaviour*, McGraw Hill, International
3. Morgan C.t.,King R.A.,John Rweisz &John Schoples, *Introduction to Psychology*, McHraw Hill
4. Blum M.L. Naylor J.C., Harper & Row, *Industrial Psychology*, CBS Publisher

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PE09 L25: Entrepreneurship

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an idea on entrepreneurial perspectives*

Module I (14 hours)
Entrepreneurial perspectives- understanding of entrepreneurship process- entrepreneurial decision process- entrepreneurship and economic development- characteristics of entrepreneur- entrepreneurial competencies- managerial functions for enterprise.

Module II (14 hours)
Process of business opportunity identification and evaluation- industrial policy- environment- market survey and market assessment- project report preparation-study of feasibility and viability of a project-assessment of risk in the industry

Module III (13 hours)
Process and strategies for starting venture- stages of small business growth- entrepreneurship in international environment- entrepreneurship- achievement motivation- time management creativity and innovation structure of the enterprise- planning, implementation and growth

Module IV (13 hours)
Technology acquisition for small units- formalities to be completed for setting up a small scale unit- forms of organizations for small scale units-financing of project and working capital-venture capital and other equity assistance available- break even analysis and economic ratios technology transfer and business incubation

Text Books

1. Harold Koontz & Heinz Weihrich, *Essentials of Management*, McGraw hill International
2 Hirich R.D. &Peters Irwin M.P., *Entrepreneurship*, McGraw Hill
3. Rao T.V., Deshpande M.V., Prayag Mehta &Manohar S. Nadakarni, *Developing Entrepreneurship a Hand Book*, Learning systems
4. Donald Kurado & Hodgelts R.M., *Entrepreneurship A contemporary Approach*, The Dryden Press
5. Dr. Patel V.G., *Seven Business Crisis*, Tata McGraw hill
Timmons J.A., *New venture Creation- Entrepreneurship for 21st century*, McGraw Hill International
6. Patel J.B., Noid S.S., *A manual on Business Oppurnity Identification*, selections, EDII
7. Rao C.R., *Finance for small scale Industries*
8. Pandey G.W., *A complete Guide to successful Entrepreneurship*, Vikas Publishing

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

ME09 L22: Quality Engineering and Management

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To analyse key definitions of quality, focusing on a customer-centric approach.*
- *To provide knowledge on the managerial tools and techniques on quality*
- *To analyze the relationship of statistics to a process and to use the statistical tools*
- *To analyze and generate acceptance sampling plans*
- *To provide knowledge on the reliability and life testing of components and systems*

Module I (14 hours)

Concepts of quality: Quality – Quality control – Quality assurance – Quality management- Quality costs

Total Quality Management: Axioms – Management commitment- Deming's approach – Quality council – Customer satisfaction and retention – Employee involvement and empowerment – Suggestion system – Quality circle – Continuous process improvement – Juran's trilogy – PDSA cycle – Kaizen – Six-sigma – Crosby's quality treatment

Module II (13 hours)

Management tools and techniques: Benchmarking – ISO quality management systems – Quality function deployment – Quality by design – Failure mode and effect analysis – Affinity diagram – Block diagram – Pareto chart – Fish bone diagram – Flow chart – Run chart – Scatter diagram – Tree diagram – Matrix diagram

Module III (14 hours)

Statistical tools 1-control charts: Basic concepts - Attributes and variables - Random and assignable causes of variations- Patterns of variation - Measures of central tendency and dispersion - Probability distributions: Binomial, Poisson and Normal

Control charts for variables : $\bar{X}$, R and sigma charts – Details of construction and uses Control charts for attributes: p, np, c and u charts – Details of construction and uses

(Numerical problems included)

Module IV (13 hours)

Statistical tools 2- Acceptance sampling, Reliability and Life testing: Sampling Vs inspection - OC curve - Single and double sampling plans - ATI - AOQL - Life testing - Bathtub curve – MTBF - OC curve for Life testing - System reliability (Numerical problems included)

Reference Books

1. Bester Field, Dale H, Carol Boeterfreld – Muchna, Glen H, Boeterfreld Mery Boeterfeld-Scare, 2003, *Total Quality Management*, 3rd edition, Pearson, Education, New Delhi.
2. Logethetis, N. (1992), *Managing for Total Quality*, Prentice Hall International, Englewood Cliffs, NJ.,
3. Grant.E.L., *Stastical Quality Control*, McGraw Hill
4. Juran J.M, Gryna I.M., *Quality Planning and Analysis*, Tata McGraw Hill Publishing Company
5. Montgomery, Douglas C, 2001, *Introduction to Statistical Quality Control*, Fourth edition, John Wiley and Sons, Inc, New Delhi
6. Gerals M Smith- 2004, *Statistical Process Control and Quality Improvement*- 5th

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

ME09 L25: Energy Engineering and Management

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide knowledge on energy conservation and management.*
- *To impart the basics of renewable energy technology*

Pre-requsites: *Nil*

Module I (13 hours)
Energy and environment: Introduction – fossil fuel reserves – world energy consumption – green house effect – global warming – renewable energy sources – environmental aspects utilization – energy prices – energy policies

Module II (14 hours)
Energy conservation: Industrial energy use – energy surveying and auditing – energy index – energy cost – energy conservation in engineering and process industry, in thermal systems, in buildings and non conventional energy resources schemes.

Module III (14 hours)
Energy technologies: Fluidized bed combustion – fluidized bed boilers – waste heat recovery systems – heat pump and refrigerators – wind energy collectors and storage systems – insulated pipe work systems.

Module IV (13 hours)
Energy management: Energy management principles – energy resources management – energy management information systems – computerized energy management. Costing techniques – cost optimization – optimal target investment schedule – financial appraisal and profitability.

Text Books

1. W. R. Murphy, G. Mc Kay, *Energy Management*, Butterworths, London

Reference Books

1. O. Callaghn, *Design and Management for energy conservation*, Pergamon Press, Oxford
2. D. Merick, *Energy - Present and Future Options*, vol 1 and 2, John Wiley and Sons
3. N. A. Chaigier, *Energy Consumption and Environment*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

ME09 L23: Industrial Safety Engineering

Teaching scheme **Credits: 4**

3 hours lecture and I hour tutorial per week

Objectives

- *To provide on concept of safety in industry, principle of accident prevention, major hazards, consequences and concept of reliability.*

Pre-requisites: *Nil*

Module I (14 Hours)

Introduction to the concept of safety-Need-safety provisions in the factory Act-Laws related to the industrial safety-Measurement of safety performance, Safety Audit, Work permit system, injury and accidents-Definitions-Unsafe act –unsafe condition-causes, investigations and prevention of accidents, hazards, type of industrial hazards-nature, causes and control measures, hazard identifications and control techniques-HAZOP, FMEA,FMECA etc.

Module II (14 Hours)

Concept of Industrial hygiene, programmes-Recognition –Evaluation- Control, Noise-source –effects and noise control, exposure limits –standards, Hearing conservation programmes, Fire –fire load-control and industrial fire protection systems, Fire Hydrant and extinguishers, Electrical Hazards, protection and interlock-Discharge rod and earthling device, safety in the use of portable tools.

Module III (13 Hours)

Logics of consequence analysis-Estimation-Toxic release and toxic effects-Threshold limit values, Emergency planning and preparedness, Air pollution-classification-Dispersion modeling -pollution source and effects- -control method and equipments-Gravitational settling chambers-cyclone separators-Fabric filter systems-scrubbers etc.

Module IV (13 Hours)

Concept of reliability-Definition-Failure rate and Hazard function, System reliability models-series, parallel systems, reliability hazard function for distribution functions-exponential-normal –lognormal-weibull and gamma distribution.

Text books

1. Thomas J. Anton, *Occupational Safety and Health Management*, McGraw Hill
2. Ian T.Cameron & Raghu Raman, *Process Systems Risk Management*, ELSEVIER Academic press.
3. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International Limited
4. L. S. Srinath, *Reliability Engineering*, East west Press, New Delhi.

Reference books

1. Frank E. McErloy,P.E; C.S.P, *Accident Prevention Manual for Industrial Operations*,NSC Chicago.
2. Lees F.P, *Loss Prevention in Process Industries*, Butterworths, New Delhi.
3. BHEL,*Occupational Safety Manual*, Tiruchirappalli.
4. Dr. A.K. Gupta, *Reliability, Maintenance and Safety Engineering*, Laxmi Publications, New Delhi.

Internal Continuous Assessment (Maximum Marks-30)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz,
literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

AN09 L24 PROJECT MANAGEMENT

Teaching scheme
3 hours lecture and 1 hour tutorial per week **credits 4**

Objectives:

To give an exposure to the major aspects of project viz. Project Planning, Analysis, Selection, Implementation and review.

Module I (13 hours)

Planning -Capital Expenditures -Phases of Capital Budgeting -Levels of decision Making -Facets of Project analysis-Feasibility Study -Objectives of Capital Budgeting -Resource Allocation framework Key Criteria-Elementary Investment strategies -Portfolio planning tools -Generation of ['project Ideas Monitoring the environment -Corporate appraisal -Scouting for project ideas -Preliminary Screening Project rating index -Sources of Positive net present value

Module II (14hours)

Analysis -Market and demand analysis -Situational analysis and specification of objectives -Collection of secondary information -Conduct of market survey -Characterization of Market -demand Forecasting -Market planning -Technical analysis-Material inputs and utilities -Manufacturing process/technology -Product Mix -Plant capacity -Location and site -machineries and equipments -Structures and civil works -Project charts and layouts -Work schedule -Financial Analysis -Cost of project -means of finance -Estimates of sales and Production -Cost of production -Working capital requirements and its financing -Profitability projections -Break even point -projected cash flow statements and balance sheets

Module III (13hours)

Project Cash flows -Basic I single amount -Future value of an annuity -Present value of a single amount -Present Value of an annuity-Cost of capital -Cost of debt capital -cost of preference capital -Rate of return -Cost of external equity and retained earnings -Determination of weights -Appraisal criterion -Net present value Cost benefit ratio-Internal rate of return-Urgency -payback period

Module IV (14hours)

Implementation-Forms of Project organization -Project planning -Project control -Human Aspects of Project management -Network Techniques -Development of Network -Time estimation -Critical path determination -Scheduling under limited resources -PERT Model-CPM Model -Network Cost System -Project review-Initial; review -Performance evaluation-Abandonment **analysis**

Text Book:

Prasanna Chandra, *Projects Planning, Analysis, Selection, Implementation and Review·. Fourth Edition,* Tata McGraw-Hill.

Reference books

I. Dennis Lock, *Project Management,* Grower Publications

2. Prasanna Chandra, *Financial Management Theory and Practice*, Tata McGraw Hill Publishers

3. Parameswar P Iyer, *Engineering Project management,* Vikas publishers

4. Gido & Clements, *Success/iii Project Management,* Vikas Publishers

5. Harold.T..Amrine John.A.Ritchey, *Manufacturing Organisation and Management,* Pearson Education

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Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

CH09 L24 INDUSTRIAL POLLUTION CONTROL

Teaching scheme **Credits:** 4

3 hours lecture & 1 hour tutorial per week

Objectives

- *To impart the basic concepts of industrial pollution control*
- *To develop understanding about water, air, light pollution control*

No Pre-requisites

Module 1 (13hours)

Classification of industrial wastewater - types of pollutants and their effects - monitoring and analysis methods - water pollution laws and standards - industrial wastewater treatment - processes and equipment

Module 2 (13hours)

Water pollution control in industries - pulp and paper, textile processing, tannery wastes, dairy wastes, cannery wastes, brewery, distillery, meet packing, food processing wastes, pharmaceutical wastes, chlor-alkali industries, fertilizer industry, petrochemical industry, rubber processing industry, starch industries, metal industries, nuclear power plant wastes, thermal power plant wastes.

Module 3 (13hours)

Air pollution control in industries: source and classification of industrial air pollutants - monitoring equipment and method of analysis - damages to health, vegetation and materials - air pollution laws and standards - treatment method in specific industries - thermal power plants - cement - fertilizers - petroleum refineries - iron and steel - chlor-alkali - pulp and paper

Module 4 (13hours)

Industrial odour control - sources and solutions - odour control by adsorption and wet scrubbing - industrial noise control methods - sludge treatment and disposal - industrial hazardous waste management, waste minimization. Environmental Impact Assessment and risk assessment-Environmental Audit and Environmental management system- Concept of common effluent treatment plants.

References:

1. Nelson & Nemerow, Industrial Water pollution-Origin, Characteristics and treatment, Addison, Wesley Publishing Co.
2. Gerard Kiely,Environmental Engineering, McGraw Hill
3. Rao M.N. & Rao H,Air Pollution, Tata McGraw Hill
4. Sincero A.P.& Sincero G.A., Environmental Engineering, A Design Approach, Prentice Hall of India
5. Rao C.S., Environmental Pollution Control Engineering, New Age Int. Pub.
6. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw Hill
7. Babbitt H.E, Sewage & Sewage Treatment, John Wiley
8. Abbasi S.A, & Ramasami E, Biotechnical Methods of Pollution Control, Universities Press(India) Ltd.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

EC09 L023: Data Structures & Algorithms

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give ideas of basic data structures*
- *To impart knowledge about algorithm specification*

Module I (14hours)
Study of basic data structures – Arrays- Structures-Sparse matrix – Stacks – Queues- Circular queues- Priority queues - Dqueues. Evaluation of expressions – Polynomial representation using arrays.

Module II (14 hours)
Linked Lists - Linked stacks and queues - Doubly linked lists - Polynomial representation using linked lists, Strings – Data representation – Pattern matching.

Module III (15 hours)
Trees - Binary Trees – Tree Traversal – Inorder - Preorder and Postorder, Graphs – Depth first and breadth first search. Sorting methods: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort, External sorting methods (basic idea only).

Module IV (11 hours)
Principles of programming – System Life Cycle - Algorithm Specification-Recursive Algorithms- Documentation- Performance Analysis and Measurements- Time and Space complexity-Complexity calculation of simple algorithms.

Text Books

1. Classic Data Structures: Samanta, PHI
2. Data Structures and program design in C: Robert Kruse, Pearson Education Asia
3. An introduction to Data Structures with applications: Trembley & Sorenson, McGraw Hill

Reference Books

1. Fundamentals of Data Structures in C++: Horowitz, Sahni & Mehta, Galgottia Pub.
2. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum
3. Fundamental Algorithms: Knuth.
4. Algorithms + Data Structures & Programs: N.Wirth, PHI
5. Data structures in Java: Thomas Standish, Pearson Education Asia

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

One of the assignments shall be simulation using any of the tools

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

EE09 L 22 SOFT COMPUTING TECHNIQUES

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint the students with the important soft computing methodologies- neural networks, fuzzy logic, genetic algorithms and genetic programming*

Module I (12 Hours)
Artificial Intelligent systems – Neural Networks, Fuzzy Logic and Evolutionary Programming concepts. Artificial Neural Networks – Biological neural networks – Model of an artificial neuron- Comparison between biological neuron and artificial neuron– Basic models of artificial neural network –Learning methods – - Activation function and terminologies of ANN- - Mc Culloch Pitts Neuron – Linear Separability – Hebb network – Perceptron Networks , Adaline, Madaline.

MODULE II (14 Hours)
Back propagation Networks : Architecture - Multi layer perceptron –Back propagation learning – Input layer, Hidden Layer , Output Layer computations, Calculation of error, Training of ANN, Back propagation Algorithm, Momentum and Learning rate, Selection of various parameters in BP networks- Radial Basis Function Networks [T. B. 1].
Variations in standard BP algorithms – Decremental iteration procedure, Adaptive BP, GA based BP, Quick prop training, Augmented BP networks, Sequential learning Approach for single hidden layer Neural networks.

Module III (14 Hours)
Fuzzy sets and crisp sets-Fuzzy sets –Fuzzy set operations-Fuzzy relations-Membership functions – Features of the membership functions-Fuzzification-Methods of membership value assignments-Defuzzification- Defuzzification methods-Fuzzy Rule Base and approximate reasoning- Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Decomposition of rules, Aggregation of fuzzy rules- Fuzzy Inference Systems- Construction and Working Principle of FIS- Methods of FIS- Mamdani FIS and Sugeno FIS- Fuzzy Logic Control Systems- Architecture and Operation of FLC System- FLC System Models-Application of FLC Systems.

Module IV (14 Hours)
Genetic Algorithms- Basic Concepts- Creation of off- springs- Working Principle- Encoding- Fitness function- Reproduction- Roulette- Wheel Selection, Boltzmann Selection- Tournament selection- Rank Selection- Steady- State Selection- Elitism- Generation gap and steady state replacement- Inheritance operators- Cross Over- Inversion and deletion- Mutation Operator- Bit- wise operators- Generational Cycle- Convergence of Genetic Algorithm- Differences and Similarities between GA and other traditional methods- Applications.
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Text Books

1. S. N. Sivanandam, S. N. Deepa, *Principles of Soft Computing*, Wiley India Pvt. Ltd.[Module I& III]
2. R.Rajasekharan and G.A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications*, Prentice Hall of India. [Module II, & IV]

Reference Books

1. Fakhreddine O.Karray, Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education
2. S. Haykins, Neural Networks – A Comprehensive Foundation , Prentice Hall 2002.
3. L. Fausett, Fundamentals of Neural Networks, Prentice Hall 1994.
4. T.Ross, Fuzzy Logic with Engineering Applications, Tata McGrawHill, New Delhi 1995.
5. D.E. Goldberg, Genetic Algorithms in search, Optimization and Machine Learning, Addison Wesley MA, 1989.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
Note: *One of the assignments may be simulation of systems using any technical software*

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70