SCHEME AND SYLLABI FOR

EIGHTH SEMESTER

OF

BACHELOR OF TECHNOLOGY IN
CIVIL ENGINEERING

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM
### 8th Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Code</th>
<th>Subject</th>
<th>Hours / week</th>
<th>Marks</th>
<th>Sem-end Duration Hours</th>
<th>Credits</th>
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<tr>
<td>1</td>
<td>CE09 801</td>
<td>Environmental Engineering II</td>
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<td>2</td>
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**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

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CE 09 801: ENVIRONMENTAL ENGINEERING II

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Credits: 5

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)


Module II (17 Hours)

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


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

Module IV (19 Hours)
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**
2. Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd.

**Reference Books**
1. Elhers and Steel, Municipal and Rural Sanitation, 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

Syllabus - B.Tech
CE 09 802: QUANTITY SURVEY AND VALUATION.

Teaching scheme
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)

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)

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
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
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.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment</th>
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<tr>
<td>40% - Data collection, Planning/ Design and detailing/Simulation and analysis</td>
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<tr>
<td>30% - Presentation &amp; demonstration of results</td>
</tr>
<tr>
<td>20% - Report</td>
</tr>
<tr>
<td>10% - Regularity in the class</td>
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</table>
**Objective**

- *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.

<table>
<thead>
<tr>
<th><strong>Assessment in Viva-voce</strong></th>
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<tbody>
<tr>
<td>40% - Subjects</td>
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<td>30% - Project</td>
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<td>20% - Seminar</td>
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<tr>
<td>10% - Industrial training/industrial visit/educational tour or Paper presented at National-level</td>
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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: 3 hours lecture and 1 hour tutorial per week

Credits: 4

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.

Syllabus - B.Tech
### 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

### Reference books
3. Jain and Jaikrishna, Plain & Reinforced Concrete Vol.I & II, Nem Chand
4. Ferguson, Reinforced Concrete, Wiley Eastern
5. Ramchandra, Design of Steel Structures Vol. II, Standard Book House
6. Park and Paulay, Reinforced Concrete Structures
7. Pankaj Agarwal and Manish Shrikandhe, Earthquake Resistant Design of Structures, PHI

### Internal Continuous Assessment (Maximum Marks-30)

<table>
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<th>Percentage</th>
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<tr>
<td>60%</td>
<td>Tests (minimum 2)</td>
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<td>30%</td>
<td>Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.</td>
</tr>
<tr>
<td>10%</td>
<td>Regularity in the class</td>
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### 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
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 I (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
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
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
3 hours lecture and 1 hour tutorial per week

Credits: 4

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, Montmorillonite 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 of pressure distribution diagrams for cantilever and anchored sheet pile walls in cohesion less and cohesive soils-Features of earth dams(introduction only).

Reference books
2. Punmia B. C., Soil Mechanics & Foundations, Laxmi Publications
3. Venkatramiah, Geotechnical Engineering, New Age International Publishers
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
3 hours lecture and 1 hour tutorial per week

Credits: 4

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)

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
2. P.C.Varghese, Foundation Engineering, Prentice-Hall of India Private Ltd, New Delhi
7. Venkatramiah, Geotechnical Engineering, New Age International Publishers
8. Teng W.C., Foundation Design, PHI
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

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**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
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:
5. David Croney, ‘The Design and Performance of Road pavements’, HMSO publications

Syllabus - B.Tech
### 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
3 hours lecture and 1 hour tutorial per week

Credits: 4

Module I (13 hours)

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 - esters - alcohols - cyclic aliphatic compounds - mercaptans - 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
2. Odum E.P., Ecology & Our Endangered Life Support Systems
3. Kudesia V.P., Environmental Chemistry

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
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:
References:
3. V. Kalayanaraman, Advances in steel structures. 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: 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
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (11 hours)

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 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
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 homework, 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 $5 \times 2$ 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 $4 \times 5$ 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 $4 \times 10$ marks=$40$ Marks
Two questions from each module with choice to answer one question.
Maximum Total marks: 70
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
4. Murthy V.N.S., Soil Mechanics anfd Foundation Engineering, DhanpathRai
5. Coduto, Geotechnical Engineering Principles and Practices, Pearson Education
7. Tomlinson M J., Foundation Design and Construction, Pitman
University of Calicut

**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 $5 \times 2$ 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 $4 \times 5$ 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 $4 \times 10$ marks = 40 Marks
Two questions from each module with choice to answer one question.
*Maximum Total marks: 70*
Objective:
To make the students aware of the importance of surface water resources and strategic background 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.
Rain water harvesting – water scarcity in Kerala – reasons – manmade alterations in hydrologic cycle – methods of water conservation

Module II (13 Hours)

Module III (13 Hours)

Module IV (14 Hours)

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:
McCuen R.H, Hydrologic analysis and design, Prentice Hall
Singh V.P., Elementary Hydrology, Prentice Hall of India
Rao K. L., Water resources of India,
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.

References books
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 $5 \times 2$ 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 $4 \times 5$ 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 $4 \times 10$ marks = 40 Marks
Two questions from each module with choice to answer one question.

Maximum Total marks: 70
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.
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.

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)

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

Syllabus - B.Tech
### Text Books:
2. Gurucharan Singh and Jagdish Singh, Building Planning and Scheduling, Standard Publishers and Distributers.

### Reference books:
1. Banister Fletcher, A History of World Architecture
5. Lewis Keeble, Principles and practice of Town and Country Planning.
6. Peter Hall, Urban & Regional Planning.
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

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)

Module – III (15 hours)

Module –IV (13 hours)


Text Books
### References books
3. F. Harris - Modern Construction and Ground Engineering Equipment and Methods, Prentice Hall.

### 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 \(5 \times 2\) 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 \(4 \times 5\) 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, \(4 \times 10\) marks= 40 Marks
Two questions from each module with choice to answer one question.

*Maximum Total marks: 70*
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)

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:

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
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 - seeage under a dam - ground water 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 IV (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
3 hours lecture and 1 hour tutorial per week

Credits: 4

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–exposions 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

Module III (12 hours)

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

Syllabus - B.Tech
Internal Continuous 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 exercises, etc.
- **10%** - Regularity in the class

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<thead>
<tr>
<th>University Examination pattern</th>
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<tr>
<td><strong>PART A:</strong> Short answer questions $5 \times 2$ marks = 10 Marks</td>
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<tr>
<td>All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.</td>
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<tr>
<td><strong>PART B:</strong> Analytical / Problem solving questions $4 \times 5$ marks = 20 Marks</td>
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<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>PART C:</strong> Problem solving questions $4 \times 10$ marks = 40 Marks</td>
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<tr>
<td>Two questions from each module with choice to answer one question.</td>
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*Maximum Total marks: 70*
CE09 L22: ENVIRONMENTAL POLLUTION CONTROL ENGINEERING*

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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)


Module II (13 Hours)


Module III (14 Hours)


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.
4. Bethea R.M, Air Pollution Control technology, Van Nostrand Reinhold Co.
5. Flintoff F, Management of solid waste in developing countries, WHO.
7. Water Pollution Act (1974) passed by Govt. of India.
8. Air pollution Control act of India.
**University Examination pattern**

**PART A:** Short answer questions $5 \times 2$ 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 $4 \times 5$ 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 $4 \times 10$ marks = 40 Marks
Two questions from each module with choice to answer one question.

*Maximum Total marks: 70*

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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
**CE09 L23: EXPERIMENTAL STRESS ANALYSIS***

**Teaching scheme**
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 piezoelectric 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.
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 deformeter and its use - simple design of direct and indirect models

**Text Books**
1. Dally, J. W. and Raliley 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

**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 $5 \times 2$ 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 $4 \times 5$ 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 $4 \times 10$ marks = 40 Marks
Two questions from each module with choice to answer one question.

*Maximum Total marks: 70*
Objective
To make the students aware of the technological developments in the geographical database management and its advantages.

Module I (14 Hours)

Module II (14 Hours)
Optical and Microwave Remote sensing:

Module III (13 Hours)

Module IV (13 Hours)

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
### References:

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

Module I (14 hours)


Module II (13 hours)

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)

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
Reference books:
1. Desai C.S., Elementary Finite Element Method, Prentice Hall of India

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

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)

Module II (13 hours)

Module III (13 hours)

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.

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4
Text Books

Reference Books

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*
PE09 L24: Industrial Psychology

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give awareness on the Human and Industrial Psychology

Module I (14 hours)

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
2. Luthans, Organizational Behaviour, McGraw Hill, International

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
<table>
<thead>
<tr>
<th>PART A:</th>
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<th>Descriptive/Analytical/Problem solving questions</th>
<th>4 x 10 marks=40 marks</th>
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<td>Two questions from each module with choice to answer one question.</td>
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*Maximum Total Marks: 70*
PE09 L25: Entrepreneurship

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

**Credits:** 4

**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**
7. Rao C.R., *Finance for small scale Industries*

**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 L22: Quality Engineering and Management

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

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 : 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


## 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
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Pre-requisites: Nil

Module I (13 hours)

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)

Module IV (13 hours)

Text Books

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

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

Syllabus - B.Tech
## 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 L23: Industrial Safety Engineering

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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)

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
3. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International Limited
Reference books

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 (14 hours)

Module III (13 hours)
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 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 (14 hours)
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

Syllabus - B.Tech
Text Book:

Reference books

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*
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 (13 hours)
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 (13 hours)
Water pollution control in industries - pulp and paper, textile processing, tannery wastes, dairy wastes, cannery wastes, brewery, distillery, meat 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 (13 hours)

Module 4 (13 hours)

References:
5. Rao C.S., Environmental Pollution Control Engineering, New Age Int. Pub.
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**

$4 \times 5 \text{ marks} = 20 \text{ marks}$

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**

$4 \times 10 \text{ marks} = 40 \text{ marks}$

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

*Maximum Total Marks: 70*
EC09 L023: Data Structures & Algorithms

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

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

Module I (14 hours)

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)

Module IV (11 hours)

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

2. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum
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
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (12 Hours)

Module II (14 Hours)

Module III (14 Hours)

Module IV (14 Hours)

Syllabus - B.Tech
University of Calicut

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

Text Books

Reference Books
1. Fakhreddine O.Karray, Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education

Text Books

Reference Books
1. Fakhreddine O.Karray, Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education