SIR PADAMPAT SINGHANIA UNIVERSITY UDAIPUR

School of Engineering

Department of Civil Engineering

Vision

To establish an outstanding center of national and international reputation that brings out civil engineers with high technical competencies; to offer specialized courses dealing with the contemporary issues and cater to the societal needs; to promote consultancy and high-end research to meet the current and future challenges in the field of civil engineering.

Mission

To serve the society by imparting quality of education and skills to its students.

To prepare our students to be the technical, business and global leaders of tomorrow by inculcating technical, communication skills and teamwork.

To promote research and consultancy for industrial and societal needs.

To instill moral, ethical and professionalism values among the students.

M. Tech. Degree Programme (Regular)
Course Structure

(2022-2024)

SIR PADAMPAT SINGHANIA UNIVERSITY

Udaipur

SCHOOL OF ENGINEERING

Course Curriculum of 2-Year M. Tech. Degree Programme in Civil Engineering with specialization in Transportation Engineering (Batch- 2022-24)

Overview

The Transportation Engineering specialization under the Department of Civil Engineering offers a wide range of subjects by keeping in view the current trends and future infrastructural demands. The curriculum provides inclusive knowledge of Pavement Design to hands-on experience with pavement materials through laboratory sessions.

Programme Educational Objectives (PEOs)

PEO1 – Accomplishment: Graduates will lead successful professional life by applying their domain specific knowledge demonstrating leadership skills with ethical attitudes in broad societal context while working in a multi/inter disciplinary setting.

PEO2 – Competence: Graduates will excel in providing ethical solutions as an individual or a member or a leader of a team by investigating, analysing, formulating and solving complex engineering problems for the sustainable development of society.

PEO3 – Expertise: Graduates will exhibit professionalism while communicating with local, national and foreign peers bound with regulations and leading life- long learning.

Program Outcomes (PO's)

PO1: Core Knowledge: Graduates will demonstrate an ability to identify, formulate and solve complex engineering problems in the area of specialization and evaluate them to select optimal feasible solution considering safety, environment and other realistic constraints.

PO2: Modern and Advanced Tools: Graduates will demonstrate skills to use modern engineering tools, software, and equipment to analyze and solve complex engineering problems using multidisciplinary approach.

PO3: Research Aptitude: Graduates will demonstrate skill of good researcher to work on a problem, starting from scratch to research into literatures, methodologies, techniques, tools, and conduct experiments and interpret data to develop methodologies, techniques, modern tools and products for the betterment of society.

PO4: Report Writing: Graduates will be able to present their work unequivocally before scientific community through reports and presentations to give and take clear instructions.

PO5: Ethics and Sustainable Development: Graduates will exhibit the traits of professional integrity and ethics and demonstrate the responsibility to implement the research outcome for sustainable development of the society.

Program Specific Outcomes (PSOs)

PSO1: Professional Excellence (Mastery): Graduates will demonstrate research skills to critically analyse complex transportation Engineering problem for synthesizing new and existing information for their solutions.

PSO2: Research problem solving skills: Graduates will be able to take up real life and/or research-related problems in the field of analysis and design of pavements and to create optimal solutions to these problems.

Batch: 2022-24

Postgraduate Core (PC)		Postgraduate Elective (PE)	
Category	**Credits**	**Category**	**Credits**
Professional Core Subjects	27	Professional Electives	12
Total	27	Total	12
		Grand Total	39

Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact Hours/Week
1	I	20	21
2	II	19	19
	Total	39	--

Course Structure: M. Tech. 2022-24

Semester - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MAS4103	Application of Statistical Methods	3	1	0	4
2	CEE4109	Pavement Materials	3	0	1	4
3	CEE4107	Advanced Concrete Science & Technology	3	0	0	3
4	CEE4110	Traffic Engineering	3	0	0	3
5	CEE4104	Environmental Impact Assessment	3	0	0	3
6	PE-I	Professional Elective - I	3	0	0	3
					Total Credits	20
					Total Contact hours/week	21

Semester - II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CEE4206	Pavement Analysis and Design	3	1	0	4
2	CEE4202	Research Methodology and IPR	3	0	0	3
3	CEE4207	Urban Transportation Planning	3	0	0	3
4	PE-II	Professional Elective - II	3	0	0	3
5	PE-III	Professional Elective - III	3	0	0	3
6	PE-IV	Professional Elective - IV	3	0	0	3
					Total Credits	19
					Total Contact hours/week	19

List of Professional Elective(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit
1	CEE4141	Global Climate Change Adaptation & Mitigation measures	3	0	0	3
2	CEE4153	Advanced Foundation Design	3	0	0	3

List of Professional Elective(s) - II

S. No.	Course Code	Course Title	L	T	P	Credit
1	CEE4242	Environmental Health & Safety	3	0	0	3
2	CEE4252	Ground Improvement Techniques	3	0	0	3
3	CEE4205	Advanced Construction Techniques & Management	3	0	0	3
4	CEE4261	Pavement Maintenance and Management Systems	3	0	0	3

List of Professional Elective(s) - III

S. No.	Course Code	Course Title	L	T	P	Credit
1	CEE4254	Advanced Bridge Engineering	3	0	0	3
2	CEE4262	Advanced Traffic Engineering	3	0	0	3

List of Professional Elective(s) - IV

S. No.	Course Code	Course Title	L	T	P	Credit
1	CEE4247	Advanced Environmental Management	3	0	0	3
2	CEE4259	Repair and Rehabilitation of Structures	3	0	0	3
3	CEE4260	Cost Management of Engineering Projects	3	0	0	3
4	CEE4263	Advanced Soil Mechanics	3	0	0	3

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Semester – I

(Departmental Core Subject)

MAS4103	L-T-P-C
Application of Statistical Methods	3-1-0-4
Prerequisite	Engineering Mathematics

Objective: *The course is designed to offer knowledge about the application of mathematical models for biological application. It provides fundamental ideas on the useful of data analysis, interpretation & inference including plan for future investigation based on experimental data collected from the conduct of biological experiments*

Course Outcomes: *At the end of this course the student will be able to: Organize, manage and present data. Calculate and interpret the correlation between two variables. Employee the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient. Analyze statistical data using measures of central tendency, dispersion and location.*

Course Content

Module 01: Distribution

Binomial, Poisson & Normal distributions - Definitions, Simple problems only (Derivations not included).

Module 02: Curve Fitting

Principle of Least Squares, Fitting of straight line & parabola - Correlation - Karl Pearson's coefficient of correlation & Spearman’s rank correlation - Linear regression.

Module 03: Sampling Distributions

Sampling Distributions - Tests based on Normal, t, Chi-Square & F-Distributions.

Module 04: Applications of Variances

One way & Two way classification. Completely Randomized Design - Randomized Block Design - Latin square Design.

Module 05: Queuing Models

Single & multiple server Markovian queuing models - M/M/1 & M/M/c queuing models & Applications (Derivations not included).

Text/Reference Books

1. Fundamentals of Mathematical Statistics. Gupta S.C. & Kapoor V.K. Sultan Chand & sons. Reprint 2003.
2. Probability Statistics & Random Processes. Veerarajan T. TMH. First reprint. 2004

Digital Material

1. Environmental Statistical Methods. NPTEL.
   Link: https://nptel.ac.in/courses/111/105/111105077/

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Semester - I

(Departmental Core Subject)

CEE4109 L-T-P-C
Pavement Materials 3-0-0-3
Prerequisite

Objective: *The objective of this course is to: impart knowledge of various materials used in construction of pavements, their types and laboratory testing methods.*

Course Outcomes: *After the completion of the course, the student should be able to: classify different types of pavement materials, understand mechanical and durability properties of the materials used in construction of pavement.*

Course Content

Module 01: Soil - Classification, characteristics, compaction, evaluation of soil strength; stabilized pavement materials.

Module 02: Aggregates: requirements, properties, and tests on road aggregates for flexible and rigid pavements.

Module 03: Bitumen: Origin, preparation, properties and tests, constitution of bituminous road binders; requirements; Criterion for selection of different binders. Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests,

Module 04: Bituminous Mixes: Mechanical properties: Resilient modulus, dynamic modulus, and fatigue characteristics of bituminous mixes. bituminous mix design methods and specifications. Weathering and Durability of Bituminous Materials and Mixes. Performance based Bitumen Specifications.

Module 05: Superpave mix design method: design example problems.

Cement Concrete for Pavement Construction: Requirements, and design of mix for CC pavement, IRC and IS specifications and tests, joint filler, and sealer materials.

Text/Reference Books

1. Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nemchand and Bros. Roorkee. 2014.
2. Principles and Practices of Highway Engineering. Kadiyali L.R. & Lal N.B. Khanna Publishers New Delhi.
3. Highway Engineering. Sharma S.K. S. Chand Technical Publishers New Delhi. 2013.

Digital Material

1. Pavement Materials. www.swayam.gov.in.

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Semester - I

(Departmental Core Subject)

CEE4107	L-T-P-C
Advanced Concrete Science & Technology	3-0-0-3
Prerequisite	Building Material & Construction Technology

Objective: *The objective of this course is to: impart the concept of cement hydration, concrete microstructure, rheology, and early age properties of concrete; to make students understand the impact of admixtures on the properties of fresh and hardened concrete; to educate students about concrete mix design as per Indian standard and developing self-compacting concrete, fiber reinforcing concrete and light weight concrete*.

Course Outcomes: *On completion of the course students will be able to: comprehend rheology and early age properties of cement concrete; understand and assess the impact of admixtures on the properties of fresh and hardened concrete; design concrete mixes as per Indian Standard Code; develop self-compacting concrete, fiber reinforcing concrete and light weight concrete*.

Course Content

Module 01: Cement

Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste & concrete, transition Zone, Elastic Modulus, factors affecting strength & elasticity of concrete, Rheology of concrete in terms of Bingham's parameters.

Module 02: Chemical Admixtures

Mechanism of chemical admixture, Plasticizers & super plasticizers & their effect on concrete property in fresh & hardened state, Marsh Cone test for optimum design of super plasticizer, retarder, accelerator, air-entraining admixtures & new generation superplasticizers.

Module 03: Mineral Admixture

Fly ash, Silica fume, GGBS & their effect on concrete property in fresh state & hardened state.

Module 04: Mix Design

Factors affecting mix design, design of concrete mix by BIS method.

Module 05: RMC concrete

Manufacture, transporting, placing, precautions, methods of concreting - pumping, under-water concreting, shotcrete, High volume fly ash concrete- concept, properties, typical mix.

Module 06: Special types of concrete

Self- compacting concrete: Concept, materials, tests, properties, application & typical mix. Ferro cement: Materials, techniques of manufacture, properties & applications. Fibre reinforced concrete: Fibre types & properties, behavior of FRC in compression, tension including pre-cracking stage & post-cracking stages, behavior in flexure & shear. Light weight concrete: Materials properties & types. Typical light weight concrete mix, high density concrete, high strength concrete & high performance concrete- materials, properties & applications, typical mix.

Text/Reference Books

1. Concrete Technology. Neville A.M. & Brookes J.J. Pearson Publishers. New Delhi.
2. Properties of Concrete. Neville A.M. Pearson Publishers. New Delhi. 2004.
3. Concrete Technology. Shetty M.S. S. Chand & Company. New Delhi. 2002.
4. Concrete Technology. Gambhir M.L. Tata McGraw Hills. New Delhi. 1995.

Digital Material

1. Advanced Topics on Science & Technology of Concrete. Prof. Manu Santhanam. https://nptel.ac.in/courses/105/106/105106187/

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Semester – I

(Departmental Core Subject)

CEE4110	L-T-P-C
Traffic Engineering	3-0-0-3
Prerequisite	Transportation Engineering

Objective: *This course is aimed at understanding traffic characteristics, traffic studies intersections, controlling of the traffic for the safe and efficient traffic movement.*

Course Outcomes: *At the end of this course the student will be able to: understand traffic characteristics, carry out and compute the speed studies, organize, manage and present the traffic studies data. Understand elements of traffic operations therefore knowing the traffic control devices and intersections.*

Course Content

Module 01: Traffic Characteristics

Introduction of Traffic Engineering and its scope, Traffic characteristics, Road user characteristics, Vehicular characteristics, Breaking Characteristics.

Module 02: Traffic Studies

Introduction, Traffic volume study, Level of measurement of flow, Methods of traffic count; Speed studies: Running speed, journey speed, spot speed and its measurements, Presentation of data, Speed and delay study. Analysis of speed and delay speed; Origin and destination study (O& D): purpose, Applications, Collection of O& D data, Presentation of collected data, Parking study.

Module 03: Traffic Operations and Regulations

Introduction, Phases of Traffic regulations; Traffic control devices, Regulatory sign, Warning signs, Informatory signs, Traffic signals, Road markings, Traffic islands

Module 04: Intersections

Introduction, types of intersections, Advantages, Requirements of intersection, Forms of intersections, channelizes intersection, un-channelized intersection, Rotary intersection, shapes of the rotary.

Text/Reference Books

1. Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.
2. Principles and Practice of Highway Engineering. Kadiyali L.R. Khanna Publishers Delhi.
3. Transportation Engineering & Planning. Papacostas C.S. & Prevedouros P.D. Prentice Hall India. 2001.
4. Principles of Transportation Engineering. Chakroborty P. & Das A. Prentice Hall India. 2003.
5. Traffic Engineering. Roess R.P. McShane W.R. & E.S. Prassas. Prentice Hall. 1990.
6. A Textbook of Highway and Traffic Engineering. Saxena & Chandra S. CBS Publishers and Distributors. 2014.

Digital Material

2. Transportation Engineering. NPTEL.
   Link: https://nptel.ac.in/courses/105101087

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Semester - I

(Departmental Core Subject)

CEE4104	L-T-P-C
Environmental Impact Assessment	3-0-0-3
Prerequisite	Environmental Engineering

Objective: *The objective of this course is to make the students aware of the several norms, policies, rules & regulations of the Environmental Impact Assessment.*

Course Outcomes: *At the end of this course the student will be able to: (i) Identify environmental attributes for the EIA study. (ii) Identify methodology and prepare EIA reports. (iii) Specify methods for prediction of the impacts.*

Course Content

Module 01: Introduction to Enivornmental Impact Assessment

Introduction, Historical development of EIA, EIA in project cycle, Legal Aspects & objectives of EIA, General Methodology, Public participation in EIA, different components of EIA.

Module 02: Methodology

General Methodology, Public participation in EIA, different components of EIA.

Module 03: Impact prediction and assessment

Mathematical modeling for impact prediction, cumulative impact assessment, documentation of EIA findings.

Module 04: Impact Analysis, mitigation and management

Environmental impact analysis, Mitigation & impact management, case studies & environmental auditing.

Module 05: Socio-economic Impact Assessment

Concept of socio-economic impact assessment.

Text/Reference Books

3. Environmental Impact Assessment - Practical solutions to recurrent problems. Lawrence D.P. Wiley-Interscience. New Jersey. 2003.
4. Environmental Impact Assessment. Canter L.W. McGraw Hill. New York. 1996.
5. Environmental Impact Analysis: Process and Methods. James. T. Maughan. CRC Press. 2017.

Digital Material

1. Environmental Impact Assessment. NPTEL.
   Link: https://nptel.ac.in/courses/120/108/120108004/
2. Website of Ministry of Environment, Forest and Climate Change, Government of India. Link: http://moef.gov.in/

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Semester – II

(Departmental Core Subject)

CEE4206	L-T-P-C
Pavement Analysis and Design	3-1-0-4
Prerequisite	Transportation Engineering

Objective: *The course is designed to offer knowledge about the pavements and to develop students' technical competence in the analysis and design of road pavements. The ability to analyse and design different types of pavements together with their material characterisation, construction aspects is considered.*

Course Outcomes: *At the end of this course the student will be able to: Analysis the design methods of flexible and rigid pavements under a variety of traffic loadings, subgrade and environmental conditions. Apply appropriate numerical and analytical procedures in design of rigid and flexible pavements.*

Course Content

Module 01: Introduction

Types of pavements – Factors affecting design of pavements – wheel loads –ESWL Concept- tyre pressure – contact pressure, Material characteristics – Environmental and other factors.

Module 02: Stresses in Flexible Pavement

Stresses in flexible pavement – layered systems concept – one layer system – Business Two layer system – Burmister Theory for Pavement Design.

Module 03: Stresses in Rigid Pavement

Stresses in rigid pavements – relative stiffness of slab, modulus of sub-grade reaction, Westergaard's stresses due to warping, stresses due to loads, stresses due to friction. **Module 04: Flexible Pavement Design**

Pavement design: CBR Method of Flexible Pavement Design- IRC method of flexible pavement design, Analysis of flexible pavement layer as per IRC 37, Low volume flexible pavement design as per IRC codal provisions.

Module 05: Rigid Pavement Design

IRC method of Rigid pavement design – Importance of Joints in Rigid Pavements-Types of Joints – Use of Tie Bars and Dowell Bars. Joint Filler and sealer.

Text/Reference Books

1. Yoder and Wit Zork, Principles of Pavement Design.
2. Dr. L.R. Kadiyali, Traffic Engineering and Transportation Planning, Khannan Publishers, 7 th Edition, 2007.
3. C. JotinKhinsty and B. Kent Lall, Transportation Engineering

Digital Material

1. Pavement analysis and design. NPTEL.
   Link: https://nptel.ac.in/courses/105104098
2. Introduction to Pavement Design
   Link: https://www.civil.iitb.ac.in/tvm/nptel/401_lnTse/web/web.html

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Semester - II

(Departmental Core Subject)

CEE4202 L-T-P-C
Research Methodology and IPR 3-0-0-3

Objective: *The objective of this course is to impart knowledge about the research problem formulation, ethics and IPR as applicable in research and development.*

Course Outcomes: *On completion of this course the student will be able to understand research problem formulation; Analyze research related information; Follow research ethics and understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity. They will be able to understand that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering. They will be able to understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*

Course Content

Module 01: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Module 2: Effective literature studies approaches, analysis Plagiarism, Research ethics

Module 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Module 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Module 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Module 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text/Reference Books

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
4. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

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Semester – II

(Departmental Core Subject)

CEE4207	L-T-P-C
Urban Transportation Planning	3-0-0-3
Prerequisite	Traffic Engineering

Objective: *The aim of this course is to Impart the knowledge of urban transportation system, know about the process & concepts of transportation planning & to study about trip generation & trip distribution by various methods and to make it economic justification of projects.*

Course Outcomes: *On the completion of this course students will be able to describe the information for planning and operation of urban transport, understanding the issues and challenges in the Transportation Sector and summarize the process of trip generation; learn and understand demand distribution models (gravity models), interpret travel demand forecasting problems, attraction regression models; understand transportation project planning and economic evaluation of transportation projects.*

Course Content

Module 01: Urban Transportation System Planning

Introduction, Objectives, Historical Development of Transport, Transportation in the Cities, modes of transport, ranking of modes, Transport Planning Process, Travel demand, transportation problems and identification, solution.

Module 02: Trip Generation

Introduction, Zonal Models, Category Analysis, trip attraction, trip production, Household, Institutional household, Trip Generation Analysis.

Module 03: Trip Distributions

Introduction, Presentation of Trip-Distribution Data, PA and OD matrix, PA Matrix to OD Matrix, Basis of Trip Distribution, Gravity Model of Trip Distribution, Calibration of Gravity Model. Regression analysis, case studies, Model split, route assignment.

Module 04: Road Planning and Economics

User Benefits and Vehicle operation Cost, economic evaluation, Cost & Benefits of project, project cost, economic analysis, techniques of economic Analysis, case studies, sources of revenue, travel time saving, monetary evaluation of travel time saving, road pricing.

Text/Reference Books

1. Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.
2. Principles and Practice of Highway Engineering. Kadiyali L.R. Khanna Publishers Delhi.
3. Principles of Transportation Engineering. Chakraborty Partha & Das A. Prentice Hall India Learning Pvt. Ltd. New Delhi. 2013.
4. An Introduction to Transportation Planning (The Living Environment). Bruton M. J. UCL Press. London. UK. 2000.
5. Transportation Planning Handbook. Edwards J. D. 2nd Ed. Institution of Transportation Engineers.1999.
6. Principles of Urban Transportation System Planning. Hutchinson. B.G. McGraw Hill. 1974.
7. Urban Transportation Planning: A Decision Oriented Approach. Mayer M. & Miller E. McGraw Hill. 2000.

Digital Material

1. Urban Transportation Planning
   https://nptel.ac.in/courses/105/107/105107067/

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Semester - II

(Departmental Core Subject)

CEE4205 L-T-P-C
Advanced Construction Techniques & Management 3-0-0-3
Prerequisite Construction Management

Objective: *The objective of this course is to: familiarize students with modern construction planning techniques; enable students understand various construction methods and different construction control and management techniques.*

Course Outcomes: *On completion of this course the student will be able to: understand and apply modern construction planning techniques; comprehend different construction methods and control management techniques.*

Course Content

Module 01: Construction Planning

Construction facilities, Schedules, Layout of Plant utilities.

Module 02: Construction Methods

Excavation & handling of Earth & Rock; Production & handling of Aggregates & Concrete, cooling of concrete in dams, Drainage treatment of aquifers/sub-terrainian reservoirs; Tunneling, Tunneling in soft rocks, Grouting, chimney formation, etc.

Module 03: Construction Control & Management

CPM/PERT, Human Factors, Organization.

Text/Reference Books

1. Construction Planning, Equipment & Methods. Peurifoy R.L. & Ledbetter W.B. McGraw Hill Singapore. 1986.

2. Total Project Management- The Indian Context. Joy P.K. MacMillan India Ltd. New Delhi.1992.

Digital Material

1. Project Planning & Control. https://nptel.ac.in/courses/105/106/105106149/

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Semester - I

(Professional Elective-I)

CEE4141 L-T-P-C

Global Climate Change Adaptation & Mitigation 3-0-0-3

Prerequisite Environmental Engineering

Objective: *To develop a basic knowledge about the climate change & mitigation measures.*

Course Outcomes*: Upon successful completion of this course, it is expected that students will be able to: Be familiar with the*

Course Content

Module 01: Introduction

Introduction to global climate; Global climatic models; Methods of reconstructing climate

Module 02: Fundamental

Quaternary climates, sea level changes, glacial/interglacial cycles; Geological records of climate change, sedimentology, stable isotopes, geochemistry

Module 03: Regulatory

Geochronology – relative and numerical methods;

Module 04: Water

Vegetation dynamics, migration history, the response of vegetation to climatic reversals

Text/Reference Books

1. Climate Mitigation and Carbon Finance Global Initiatives & Challenges. Sahoo, A.K. New India Publishing Agency, 2012.

Digital Material

1. Introduction to climate change https://youtu.be/hwWuZ9EnrCI

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Semester - I

(Professional Elective - I)

CEE4153	L-T-P-C
Advanced Foundation Design	3-0-0-3
Prerequisite	Reinforced Concrete Structures

Objective: *To equip the students to understand the analysis & design of various foundation systems required for various infrastructure projects.*

Course Outcomes: *On completion of the course students will be able to: identify a suitable foundation system for a structure; evaluate the importance of raft foundation and principles of design for buildings and tower structures; analyze and design pile foundations*.

Course Content

Module 01: Bearing Capacity

Bearing capacity on slopes, settlement analysis of foundation on sand & clay. Advanced bearing capacity theories.

Module 02: Shallow Foundation

Design of isolated footing & steel grillage, combined footing of rectangular, trapezoidal cantilever types, Mat, or raft foundation of dry & saturated soil floating foundations.

Module 03: Deep Foundation

Settlement of piles; vertical & lateral loads in pile foundation, negative skin friction & uplift capacity of pile, design of pile caps, design of well foundation & caissons of different types, design of bridge pairs resting on piles & machine foundation.

Module 04: Retaining structures

Design of retaining walls- Gravity, cantilever & counterfort type. Design of sheet piles & cofferdams, braced excavations.

Text/Reference Books

1. Design of Foundation Systems: Principles & Practices. Kurien N.P. Narosa. New Delhi. 1992.
2. Foundation Analysis & Design. Bowles J.E. Mc-Graw Hill Book & Company.
3. Principles of Foundation Engineering. Das B.M. Thomson Brooks/Cole.

Digital Material

1. Advanced Topics on Advanced Foundation Design. https://nptel.ac.in/courses/105/108/105108069/

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Semester - II

(Departmental Professional Elective-II)

CEE4242	L-T-P-C
Environmental Health & Safety	3-0-0-3
Prerequisite	Environmental Engineering

Objective: *To Train and motivate students in maintaining and improving the quality of the environment and preventing & abating environment pollution. This has the blending mixture of both Learning and Skills*

Course Outcomes: *Upon successful completion of this course, the student will have reliably demonstrated the ability to: Identify a variety of biological, chemical and physical hazards and recommend prevention and control measures, including confined space entry. Identify applications of environmental health and safety protocols and procedures. Utilize current legislation and regulations including the Occupational Health and Safety Act, Workplace Hazardous Materials Information System (WHMIS), Environmental Protection Act and Transportation of Dangerous Goods Act.*

Course Content

Module 01: Scope and Importance

Need for public awareness about our environment; Economic and social security; Environment impact of transportation and Mining. Environmental impact assessment (EIA) — purpose, procedure and benefits of EIA; Biodiversity and its conservation; Sustainable development. Global warming and greenhouse effect, urbanization, acid rain, ozone layer depletion, nuclear accident and holocaust.

Module 02: Environmental pollution

Causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution and nuclear hazards, Solid waste management-urban and industrial waste-causes, effects and control measures.

Module 03: Renewable and non-renewable natural resources

Forest resource, Water resource, Mineral wealth / resource, Food resource, Energy resources, Growing energy needs, renewable and non-renewable energy sources, Use of alternate energy sources, Land resource and land degradation, Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles.

Module 04: Role of Government in environment protection

Legal aspects of environment protection, NGO initialization, National Committee on environmental Planning (NCP), Environmental Appraisal Committee (EAC), central and state boards for prevention and control of pollution, goals of environment impact policy, case studies, Disaster management floods, earth quake, cyclone, landslides, role of individual in prevention of pollution.

Text/Reference Books

1. Environmental Studies. Joshep B. Tata Mc Graw Hill. 2005.
2. Environmental Pollution Control. Rao C.S. New Age International Pvt. Ltd Publishers. 2006.
3. Environmental Studies. Manjunath D.L. Pearson Education Publishers. 2007.
4. Text Book of Environmental Studies. Yaji R.K. United Publishers. 2006.
5. Centre for Environmental Education. Essential learning's in Environmental education. 1990.
6. Principles of Environmental Science and Engineering. Venugopal Rao P. Prentice Hall. 2006.

Digital Material

1. Wastewater Management Dr. M.M. Ghangrekar https://nptel.ac.in/courses/105/105/105105048/

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Semester - II

(Departmental Elective - I)

CEE4252	L-T-P-C
Ground Improvement Techniques	3-0-0-3
Prerequisite	Soil Mechanics

Objective: *This course provides an overview of latest ground improvement techniques. This course will help to understand the problems related to soil & select the best method to improve the soil. This course gives the detail knowledge of various soil stabilization techniques.*

Course Outcomes: *On completion of this course: The students will be able to understand the different ground improvement techniques. The graduate will be able to understand the methods of stabilization. The graduate will be able to understand the methods and properties of reinforced soil.*

Course Content

Module 01: Soil compaction

laboratory methods, field methods, compaction control.

Module 02: Soil stabilization

Using additives, sand drains, stone columns, lime columns.

Module 03: Grouting

Types of grouts, methods of grouting.

Module 04: Soil reinforcement

Using strips, geogrids, geotextiles, geomembranes; Dewatering methods; Soil nailing; Underpinning; Tunneling

Text/Reference Books

1. Soil Mechanics. Lambe T.W. & Whitman R.V. John Wiley & Sons. 1969.
2. Soil Mechanics in Engineering Practice. Terzaghi K., Peck R. B. & Mesri G. John Wiley & Sons. 1996.
3. Engineering Principles of Ground Modification. Hausmann M. R. McGraw Hill. 1990.

Digital Material

1. Ground Improvement Techniques
   https://nptel.ac.in/courses/105/108/105108075/

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Semester - II

(Departmental Core Subject)

CEE4205 L-T-P-C
Advanced Construction Techniques & Management 3-0-0-3
Prerequisite Construction Management

Objective: *The objective of this course is to: familiarize students with modern construction planning techniques; enable students understand various construction methods and different construction control and management techniques.*

Course Outcomes: *On completion of this course the student will be able to: understand and apply modern construction planning techniques; comprehend different construction methods and control management techniques.*

Course Content

Module 01: Construction Planning

Construction facilities, Schedules, Layout of Plant utilities.

Module 02: Construction Methods

Excavation & handling of Earth & Rock; Production & handling of Aggregates & Concrete, cooling of concrete in dams, Drainage treatment of aquifers/sub-terrainian reservoirs; Tunneling, Tunneling in soft rocks, Grouting, chimney formation, etc.

Module 03: Construction Control & Management

CPM/PERT, Human Factors, Organization.

Text/Reference Books

3. Construction Planning, Equipment & Methods. Peurifoy R.L. & Ledbetter W.B. McGraw Hill Singapore. 1986.
4. Total Project Management- The Indian Context. Joy P.K. MacMillan India Ltd. New Delhi.1992.

Digital Material

2. Project Planning & Control. https://nptel.ac.in/courses/105/106/105106149/

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Semester - II

(Professional Elective - II)

CEE4261 L-T-P-C

Pavement Maintenance and Management Systems 3-0-0-3

Prerequisite

Objective: *The objective of this course is to: introduce the basic concepts of pavement management system, pavement failure, evaluation and ratings.*

Course Outcomes: *After the completion of the course, the student should be able to: understand the pavement maintenance management system (PMMS) as a systematic method for inspection and rating the pavement condition; rate pavement through various rating procedures.*

Course Content

Module 01: Introduction to Pavement Maintenance Management System, components of pavement management maintenance measures PMMS objectives. Routine maintenance, periodic maintenance, special repairs, responsive maintenance programme, rehabilitation and reconstruction, treatment strategies and selection.

Module 02: Functional Evaluation of Pavements: Introduction, factors affecting pavement deterioration, functional condition evaluation techniques, roughness measurements, Identification of uniform sections, serviceability concepts, visual and ride rating techniques Structural requirements and Evaluation of flexible pavements – Design requirements, Structural condition evaluation techniques, factors affecting

structural condition of flexible pavements, structural behavior and evaluation of structural condition of pavements.

Module 03: NDT procedures, rebound deflection, deflection bowl measurement and analysis, IRC overlay design method, structural evaluation using falling weight deflectometer, back calculation of layer moduli, ground penetrating radar for pavement evaluation, evaluation of pavement safety: skid resistance and hydroplaning.

Module 04: Design of overlays by Benkelman Beam Rebound Deflection Technique. Pavement Serviceability concepts, Evaluation of riding quality by psychophysical method. Pavement Maintenance Measures, Implementation of Maintenance management programs.

Module 05: Software for the analysis, planning, management and appraisal of road, Concept of HDM-IV.

Text/Reference Books

1. Highway Engineering: Khanna, S.K., Justo, C. E. G. and Veeraraghavan A; Nem Chand and Bros., Roorkee (Revised 10th Edition)
2. Principles and Practice of Highway Engineering: Kadiyali, L. R.; Khanna Publishers, Delhi.
3. Principles of Transportation and Highway Engineering, Rao, G.V.; Tata McGraw Hill Publishing House Pvt. Ltd., New Delhi.
4. MORTH - Specifications for Road & Bridge Works. Ministry of Road Transport and Highways, Government of India.
5. R. Haas, W. R. Hudson, and J.P.Zaniewski, Modern Pavement Management, Krieger Publishing Company, 1984.
6. 3. W.R. Hudson, R. Haas and W. Uddin, Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation, McGraw Hill, 1997.
7. 4. H. Yang, Pavement Analysis and Design, Huang, Prentice-Hall, Inc. Englewood Cliffs, 1993.
8. 5. IRC:SP-83 “Guidelines for Maintenance, Repair and Rehabilitation of Cement Concrete Pavements.
9. 6. IRC:81 “Guidelines for strengthening of Flexible Road Pavements. Using Benkelman Beam Deflection Technique”.

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Semester - II

(Professional Elective - III)

CEE4254	L-T-P-C
Advanced Bridge Engineering	3-0-0-3
Prerequisite	Bridge Engineering

Objective: *The objective of this course is to: provide knowledge of loads and analysis for different types of bridges; impart knowledge for design of different types of RC bridges including bearings with relevant codes; provide knowledge for construction, inspection, and maintenance of bridges.*

Course Outcomes: *After the completion of the course, the student should be able to: demonstrate types of bridges, their components and selection of bridge site; analyse various types of bridges with appropriate loads and methods; design of bridges and bearings along with reinforcement details.*

Course Content

Module 01: Introduction

Site Investigation, Bridge Hydrology, Geometry of Bridges, Steel, R.C.C., Prestressed Road & Rail Bridges; Suspension & Cable Stayed Bridges: Bearings, Joints, etc.

Module 02: Design of Bridge Components

Grillage Analogy, Design of composite bridges (steel & concrete): box girder bridges in concrete. Design of abutments, piers & their foundations. Design of bearings.

Module 03: Bridge Maintenance

Construction methods & maintenance of bridges. Multi-beam & multi-cell R.C.C. bridges.

Text/Reference Books

1. Design of Bridge Structures. Jagadeesh T.R. Prentice-Hall International. 2nd Ed. 2009.
2. Elements of Bridge Engineering. Pant M.K. Katson Publication. 1st Ed. 2014.

Digital Material

1. Bridge Design Engineering. Prof. Nirjhar Dhang, IIT Kharagpur. https://nptel.ac.in/courses/105/105/105105165/

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Semester – II

(Departmental Professional Elective - III)

CEE4262	L-T-P-C
Advanced Traffic Engineering	3-0-0-3
Prerequisite	Traffic Engineering

Objective: *The course is designed to develop the knowledge about the application of engineering techniques to achieve the safe and efficient movement of people and goods on roadways.*

Course Outcomes: *At the end of this course the student will be able to: Understand techniques of Traffic forecasting, determine the traffic capacity and LOS, carry out the signal design, analyse model accidents to achieve Safe and efficient movement of people and goods on roadways*

Course Content

Module 01: Traffic Forecasting

Introduction, need of forecasting and its purpose, Factor influencing the traffic forecasting, types of traffic, Methods of forecasting, four step stage modelling.

Module 02: Traffic Flow Characteristics

Introduction, traffic manoeuvres, Traffic capacity, Traffic flow, Passenger car unit (PCU), factor affecting PCU, Traffic headways, lane occupancy, Categories of traffic flow, Fundamental diagram of traffic flow, Level of service (LOS), Green Shield model of traffic flow.

Module 03: Traffic Flow Theories

Introduction of theories, Queueing problem, assumptions, queueing theory; Car following theory; Shock wave theory; Lighthill and William theory.

Module 04: Traffic Signal

Merits and demerits of traffic signals. Classifications of traffic signals, Types of traffic signal system, Warrants for traffic control signal intersections, Design of traffic signal, IRC method signal design.

Module 05: Traffic Accident Analysis

Accident study, Objectives of the study, Causes of accident, Record accident studies data, condition diagram, Collison diagram, Accident analysis.

Text/Reference Books

1. Transportation Engineering & Planning. Papacostas C.S. & Prevedouros P.D. Prentice Hall India. 2001.
2. A Textbook of Highway and Traffic Engineering. Saxena & Chandra S. CBS Publishers and Distributors. 2014.
3. Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.
4. Principles and Practice of Highway Engineering. Kadiyali L.R. Khanna Publishers Delhi.
5. Principles of Transportation Engineering. Chakroborty P. & Das A. Prentice Hall India. 2003.
6. Traffic Engineering. Roess R.P. McShane W.R. & E.S. Prassas. Prentice Hall. 1990.

Digital Material

1. Traffic Engineering. NPTEL.
   Link: https://onlinecourses.nptel.ac.in/noc22_ce41/preview

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Semester - II

(Departmental Professional Elective - IV)

CEE4247	L-T-P-C
Advanced Environmental Management	3-0-0-3
Prerequisite	Environmental Engineering

Objective: *The subject deals with the concepts of strategies & polices used to promote cleaner production in industry & identifying strategies & polices used to promote cleaner production in industry.*

Course Outcomes*: Upon successful completion of this course, it is expected that students will be able to: Analyse and compare how strategies and methods such as environmental management systems are used to improve organization's contributions to sustainable development. Identify, analyze and evaluate sustainability aspects and propose indicators for formulation of targets and action plans for the sustainable development of an organization. Collect, analyze and present data on environmental impacts and resource flows, in order to monitor and evaluate the environmental performance of organizations*

Course Content

Module 01: Environmental Management Standards

Development, trade & environment linkages - Environmental guidelines - Business & Citizen Charters for Sustainable Production & Consumption - National policies on environment, abatement of pollution & conservation of resources - Environmental quality objectives - Environmental standards - Concentration & Mass standards Effluent & stream standards - Emission & ambient standards -Minimum national standards – Measuring performance evaluation: Indicators, Benchmarking - Systems approach to environmental management

Module 02: Preventive Environmental Management

Pollution control vis a vis Pollution Prevention - Opportunities & Barriers - Cleaner production & Clean technology, closing the loops, zero discharge technologies - source reduction, raw material substitution, toxic use reduction & elimination, process modification - Cleaner Production Assessment- Material or resource balance - CP option generation & feasibility analysis

Module 03: Environmental Management System

EMAS, ISO 14000 - EMS as per ISO 14001- benefits & barriers of EMS - Concept of continual improvement & pollution prevention - environmental policy - initial environmental review - aspect & impact analysis - legal & other requirements objectives & targets - environmental management programs - structure & responsibility - training awareness & competence- communication – documentation & document control - operational control - monitoring & measurement - management review.

Module 04: Environmental Audit & Applications

Environmental management system audits as per ISO 19011- Roles & qualifications of auditors - Environmental performance indicators & their evaluation - Non-conformance - Corrective & preventive actions -compliance audits - waste audits & waste minimization planning - Environmental statement.

Text/Reference Books

1. Environmental Management Systems & Cleaner Production. Hillary R. Wiley Publishers. 1997.
2. Installing Environmental management Systems - a step by step guide. Sheldon C. & Yoxon M. Earthscan Publications Ltd. London. 1999.
3. ISO 14001/14004: Environmental management systems - Requirements & Guidelines - International Organisation for Standardisation. 2004.

Digital Material

1. Introduction to Environment Management Systems

   https://www.youtube.com/watch?v=gsfHHnxSOm4

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Semester - II

(Professional Elective - IV)

CEE4259	L-T-P-C
Repair and Rehabilitation of Structures	3-0-0-3
Prerequisite	Reinforced Concrete Structures

Objective: *The course seeks to recognize the mechanisms of degradation of concrete structures, provide the students with the knowledge of available techniques and their application for strengthening or upgrading existing structural systems. It also provides how to conduct field monitoring and non-destructive evaluation of concrete structures.*

Course Outcomes: *After the completion of the course, the student should be able to: understand the properties of fresh and hardened concrete; Know the strategies of maintenance and repair; understand the retrofitting strategies and techniques.*

Course Content

Module 01: Introduction

Deterioration of structures with aging; Need for rehabilitation. Effects due to climate, temperature, chemicals , wear and erosion , design and construction errors , corrosion mechanism , Effects of cover thickness and cracking, Method of corrosion production., corrosion inhibitors , corrosion resistant steels , coatings , cathodic production Distress in concrete /steel structures Types of damages; Sources or causes for damages; effects of damages; Case studies.

Module 02: Structural Health Monitoring

An overview of Structural Health Monitoring, Structural Health Monitoring and Smart Materials, Structural Health Monitoring versus Non-Destructive Testing, A broad overview of smart materials, Overview of Application potential of SHM.

Module 03: Maintenance and Repair Strategies

Special concrete and mortar, Concrete chemicals , special elements for accelerator, strength gain, expansive cement , polymer concrete , sulphur infiltrated concrete , ferro cement, fibre reinforced concrete. Shotcreting; Grouting; Epoxy-cement mortar injection; Crack ceiling.

Text/Reference Books

1. Diagnosis and treatment of structures in distress Raikar R.N. R&D Centre of Structural Designers & Consultants Pvt.Ltd. Mumbai, 1994.
2. Earthquake resistant design of structures Agarwal P. Shrikhande M. Prentice-Hall of India, 2006.
3. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.

Digital Material

1. Repair & Rehabilitation of Structures Lecture Compilation. https://www.youtube.com/watch?v=i11zIlOeqfU

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Semester - II

(Professional Elective - IV)

CEE4260	L-T-P-C
Cost Management of Engineering Projects	3-0-0-3
Prerequisite	---

Objective: *The course will offer an overview of the Strategic Cost Management Process, cost concepts in decision-making and Quantitative techniques for cost management.*

Course Outcomes: *After the completion of the course, the student should be able to: understand Cost Management Process and apply the Quantitative techniques for cost management in engineering project.*

Course Content

Module 01: Introduction

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Module 02: Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance.

Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Module 03: Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning,

Module 04: Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Module 05: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Text/Reference Books

1. Cost Accounting: A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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Semester - II

(Professional Elective - IV)

CEE4263 L-T-P-C
Advanced Soil Mechanics 3-0-0-3
Prerequisite Soil Mechanics

Objective: *The course studies soil types, weight, volume, index properties, soil classification based on different systems, soil permeability, total stress, neutral stress, and effective stress in soil, deformation concept through compaction process, basic consolidation mechanism, slope failure and shear strength of soil, soil exploration, and assessing subsoil conditions.*

Course Outcomes: *Students must be able to classify soil to assess its suitability for use, determine permeability, compaction process, basic mechanism of soil consolidation, compute stresses in soil, significance of shear strength of soil, differentiate different modes of slope failure, soil exploration, and subsoil conditions.*

Course Content

Module 01: Introduction

Types of soils, Scope of soil engineering with respect to highway engineering. Comparison and difference between soil and rock. Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight-percent air voids, saturation moisture = content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry

method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method.

Module 02: Plasticity Characteristics of Soil

liquid limit, plastic limit, and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

Module 03: Permeability of Soil

Darcy's law, validity of Darcy's law. Determination of coefficient of permeability. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

Module 04: Effective Stress Principle

Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quicksand condition.

Module 05: Compaction and Consolidation of Soil

Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control. Comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Module 06: Shear Strength

Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and

CD tests, pore pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test.

Module 06: Stability of Slopes

Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Text/Reference Books

1. Soil Engineering in Theory and Practice; Alam Singh, CBS Publishers Distributors New Delhi.
2. Soil Mechanics and Foundation Engineering: V. N. S. Murthy; Saitech Publications.
3. Soil Mechanics and Foundation Engineering: K. R. Arora; Standard Publishers and Distributors New Delhi.
4. Relevant Indian Standard Specifications Codes. BIS Publications New Delhi.
5. Theoretical Soil Mechanics. Terzaghi K. John Wiley and Sons.

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Semester - III

(Professional Elective - I)

CEE4104	L-T-P-C
Environmental Impact Assessment	3-0-0-3
Prerequisite	----------

Objective: *The objective of this course is to make the students aware of the several norms, policies, rules & regulations of the Environmental Impact Assessment.*

Course Outcomes: *At the end of this course the student will be able to: identify environmental attributes for the EIA study; identify methodology and prepare EIA reports; specify methods for prediction of the impacts.*

Course Content

Module 01: Introduction to Environmental Impact Assessment

Introduction, Historical development of EIA, EIA in project cycle, Legal Aspects & objectives of EIA, General Methodology, Public participation in EIA, different components of EIA.

Module 02: Methodology

General Methodology, Public participation in EIA, different components of EIA.

Module 03: Impact prediction and assessment

Mathematical modeling for impact prediction, cumulative impact assessment, documentation of EIA findings.

Module 04: Impact Analysis, mitigation and management

Environmental impact analysis, Mitigation & impact management, case studies & environmental auditing.

Module 05: Socio-economic Impact Assessment

Concept of socio-economic impact assessment.

Text/Reference Books

6. Environmental Impact Assessment - Practical solutions to recurrent problems. Lawrence D.P. Wiley-Interscience. New Jersey. 2003.
7. Environmental Impact Assessment. Canter L.W. McGraw Hill. New York. 1996.
8. Environmental Impact Analysis: Process and Methods. James. T. Maughan. CRC Press. 2017.

Digital Material

3. Environmental Impact Assessment. NPTEL.
   Link: https://nptel.ac.in/courses/120/108/120108004/
4. Website of Ministry of Environment, Forest and Climate Change, Government of India. Link: http://moef.gov.in/

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Semester - I

(Professional Elective - I)

CEE4152	L-T-P-C
Theory and Applications of Cement Composites	3-0-0-3
Prerequisite	----------

Objective: *The objective of this course is to make the students aware of various complex composite materials like FRC, SICON, etc. and their classification.*

Course Outcomes: *At the end of this course the student will be able to:*

1. Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.

2. Classify the materials as per orthotropic and anisotropic behaviour.

3. Estimate strain constants using theories applicable to composite materials.

4. Analyse and design structural elements made of cement composites.

Course Content

Module 01: Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Module 02: Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to

Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Module 03: Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

Module 04: Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

Module 05: Application of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats, and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

Module 06: Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON and Fibre Reinforced Concrete.

Text/Reference Books

1. Mechanics of Composite Materials, Jones R. M. 2nd Ed. Taylor and Francis, BSP Books. 1998.
2. Ferrocement – Theory and Applications. Pama R. P. IFIC. 1980.
3. New Concrete Materials. Swamy R.N. 1st Ed. Blackie, Academic and Professional, Chapman & Hall. 1983.