RGM COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

DEPARTMENT OF CIVIL ENGINEERING

III B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0109205	Design of Reinforced Concrete Structural Elements	2	1	0	3	30	70	100
A0110205	Hydrology and Water Resources Engineering	2	1	0	3	30	70	100
A0111205	Geotechnical Engineering	2	1	0	3	30	70	100
OPEN ELECTIVE-I/JOB ORIENTED COURSE		2	1	0	3	30	70	100
A0112205	Geo informatics							
A0113205	Smart Cities							
A0114205	Road Safety Audit							
A0115205	Building Information Modelling							
PROFESSIONAL ELECTIVE-I		2	1	0	3	30	70	100
A0116205	Advanced Structural Analysis							
A0117205	Open Channel Hydraulics							
A0118205	Advanced Land Measurement Techniques							
A0119205	Experimental Stress Analysis							
SKILL DEVELOPMENT COURSE								
A0120205	Construction Technology and Planning Management	1	2	0	2	30	70	100
PRACTICALS								
A0195205	CAD Lab	0	0	3	1.5	25	50	75
A0196205	Geotechnical Engineering Lab	0	0	3	1.5	25	50	75
A0023205	Community Service Project/Summer Internship	0	0	3	1.5	0	100	100
	Total	**11**	**7**	**9**	**21.5**	**230**	**620**	**850**

III B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY SUBJECTS								
A0121206	Design of Steel Structural Elements	2	1	0	3	30	70	100
A0122206	Environmental Engineering	2	1	0	3	30	70	100
A0123206	Transportation Engineering	2	1	0	3	30	70	100
OPEN ELECTIVE-II/JOB ORIENTED COURSE/MOOCs		2	1	0	3	30	70	100
A0124206	Maintenance and Repair of Buildings							
A0151207	Soil Dynamics and Machine Foundations							
A0152207	Ground Water Development and Management							
A0153207	Cost Effective Housing Techniques							
PROFESSIONAL ELECTIVE-II		2	1	0	3	30	70	100
A0125206	Advanced Geotechnical Engineering							
A0126206	Prestressed Concrete							
A0127206	Hydraulic Structures							
A0128206	Bridge Engineering							
SKILL DEVELOPMENT COURSE								
A0529206	Basics of Java Programming	1	2	0	2	30	70	100
MANDATORY LEARNING COURSE								
A0014203	Indian Heritage and Culture	2	0	0	0	0	0	0
PRACTICALS								
A0197206	Geographical Information System Lab	0	0	3	1.5	25	50	75
A0198206	Environmental Engineering Lab	0	0	3	1.5	25	50	75
A0199206	Transportation Engineering Lab	0	0	3	1.5	25	50	75
	Total	**13**	**7**	**9**	**21.5**	**255**	**570**	**825**

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(A0109205) DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS

Prerequisites: Concrete Technology and Mechanics of Materials.

COURSE OBJECTIVES:

- For any construction of a Civil Engineering, structure such as a building or a bridge or a dam the knowledge of application of reinforced cement concrete (RCC) is very essential. This course provides the knowledge of different design methods of RCC Beams, Columns, Slabs etc., using respective IS 456- 2000, IS 875 (part-I and II).

COURSE OUTCOMES:

At the end of the course student is able to

- Understand the design philosophies of various methods of design.
- Design the Reinforced Concrete beams using limit state.
- Design Reinforced Concrete slabs.
- Design the Reinforced Concrete Columns and footings.
- Design structures for serviceability

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		-	2	-	-		-	-			3	2	-
CO2	3	1	3	-	2	-	-		-	-			3	2	-
CO3	3	1	3	-	2	-	-	3	-	-	1	3	3	2	-
CO4	3	1	3	-	2	-	-	3	-	-	1	3	3	2	-
CO5	3	1	3	-	2	-	-	3	-	-	1	3	3	2	-
Avg.	3	1	3		2			3			1	3	3	2	

UNIT-I INTRODUCTION

Review of Concrete making materials - Grades- properties of Concrete- Modulus of elasticity- flexural strength-Characteristic and Design Values-Partial safety factor.

Methods of design- Aims of design- RCC- Limit State method- Assumptions- Stress-Strain behavior of Steeland Concrete- Stress block parameters- General idea about working stress method.

UNIT-II SERVICEABILITY

Design for Serviceability- Concept of Serviceability- Deflection- Span to depth ratio- short term-long termdeflection due to Shrinkage, Creep- Cracking-Crack width calculation.

UNIT-III SLABS

Design of RCC Slabs- Design of One-Way, Two-way slabs and Continuous Slabs- Effect of edge conditions-Moment of resistance-Torsion reinforcement at corners.

UNIT-IV BEAMS

Analysis and Design of Singly Reinforced Beams, doubly reinforced beams, continuous beams and T beams.

UNIT-V COLUMNS

Design of RC Columns- Design principles of RC columns- Assumptions- Rectangular and Circular columns-Helical reinforcement- Minimum Eccentricity-Use of Interaction diagrams for Axial load and Moment.

UNIT-VI FOOTINGS

Introduction to footings- Types of footing - Design of Rectangular Footing, Square Footing and Combined Footing.

NOTE: All the designs to be taught in Limit State Method. IS 456-2000 and also any other relevant codes arepermitted for examination.

TEXT BOOKS

1. Limit State Design Of Reinforced Concrete, P.C.Varghese, Printice Hall of India, New Delhi, 2020.
2. Limit State Design of Reinforced Concrete, B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain,Laxmi, publications Pvt. Ltd., New Delhi,2020.

REFERENCE BOOKS

1. Reinforced concrete design, S.Unnikrishna Pillai and Devdas Menon, Tata Mc.Graw Hill, New Delhi,2020.

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(A0110205) HYDROLOGY AND WATER RESOURCES ENGINEERING

COURSE OBJECTIVES:

- A Civil Engineer requires complete understanding of hydrological cycle so that harnessing of water in various forms will be justified. This course discusses some basic topics from hydrology such as techniques for measuring the different parameters involved in a hydrological cycle, ground water hydrology, well hydraulics, and complete overview of irrigation and water application methods, open channel flow and how to design different water distribution networks.

COURSE OUTCOMES:

At the end of the course student is able to

- Understand the water cycle occurs in nature
- Apply and analyze the various abstractions from rainfall.
- Analysis of Hydrograph for design discharge of the basin.
- Understand the groundwater characteristics and application of irrigation techniques.
- Design canal distribution network.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	2	-	-	-	-	-	1	2	-
CO2	3	2	-	-	-	-	1	-	-	-	-	1	1	2	-
CO3	2	3	2	-	1	-	-	-	-	-	-	1	1	2	-
CO4	3	2	-	-	-	-	1	-	-	-	-	-	1	2	-
CO5	2	2	3	-	-	-	-	1	-	-	-	-	1	2	-
Avg.	3	2	3	-	-	-	-	-	-	-	-	-	1	2	-

UNIT-I INTRODUCTION

Introduction to engineering hydrology and its applications, Hydrologic cycle, types and forms of precipitation, rainfall measurement, types of rain gauges, computation of average rainfall over a basin, processing of rainfall data.

UNIT-II ABSTRACTION FROM RAINFALL

Evaporation, factors affecting evaporation, measurement of evaporation, Evapotranspiration, Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices. Runoff-components of runoff, factors affecting runoff.

UNIT-III HYDROGRAPH

Hydrograph Analysis, Flood Hydrograph, Effective Rainfall, Base Flow, Base Flow Separation, Unit Hydrograph, definition and limitations of applications of Unit hydrograph, derivation of Unit Hydrograph, S- hydrograph, Instantaneous Unit Hydrograph (IUH), Synthetic Unit Hydrograph. Design discharge, computation of design discharge, rational formula, Soil Conservation Service (SCS) method.

UNIT-IV GROUND WATER

Ground water Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, Darcy's law, radial flow to wells in confined and unconfined aquifers.

UNIT-V IRRIGATION

Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Indian agricultural soils, methods of improving soil fertility, preparation of land for Irrigation. Soil-water-plant relationship, vertical

distribution of soil moisture, soil moisture constants, consumptive use, Duty and Delta, factors affecting duty, depth and frequency of Irrigation, irrigation efficiencies.

UNIT-VI CANALS

Classification of canals, design of Irrigation canals by Kennedy's and Lacey's theories, balancing depth ofcutting, canal lining, types of canal lining.

TEXT BOOKS

1. Irrigation and water power engineering, B. C. Punmia and Lal, Laxmi publications pvt. Ltd., NewDelhi, 2021.
2. Engineering Hydrology, K. Subramanya, The Tata Mc graw Hill Company, Delhi, 2020.

REFERENCE BOOKS

1. Irrigation engineering and hydraulic structures, S.K Garg, Khanna publishers, 2020.
2. Engineering Hydrology, Jaya Rami Reddy, Laxmi publications Pvt. Ltd., New Delhi, 2020.
3. Irrigation and Water Resources & Water Power, P.N. Modi, Standard Book House, 2020.
4. Irrigation Water Management, D.K. Majumdar, Prentice Hall of India, 2020.
5. Engineering Hydrology, C.S.P. Ojha, Oxford Publishers, New Delhi, 2020.

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(A0111205) GEOTECHNICAL ENGINEERING

COURSE OBJECTIVES:
- Provide knowledge about soil formation, the properties of soil and the soil classification.
- Provide knowledge about the concept and methods of estimation of seepage, concept and calculation of effective stress, determination of vertical stress using different methods
- Provide knowledge compaction, consolidation phenomenon
- Provide knowledge about shear strength of soil

COURSE OUTCOMES:
At the end of the course student is able to:
- Understand various properties of soil, classify the soil given and specify suitability for an application.
- Able to find geostatic stresses and stresses due to applied loads.
- Calculate water flow through ground, and understand the effects of seepage on the stability of structures. Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement. Able understand soil compaction and Specify compaction requirements.
- Appreciate the difference between total and effective stress approaches in soil strength determination, and discriminate between drained and undrained conditions.
- Analyze and select appropriate foundation based on site condition & type of structure.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			-	-	-	1	1	1	1	1	3	2	3
CO2	3	2	2		-	-	-	1	1	1	-	1	3	2	1
CO3	3	2	2	1	-	1	1	1	1	1	1	1	3	2	3
CO4	3	2	1		-	-	-	1	1	1	1	1	3	2	2
CO5	3	2			-	1	1	1	1	1	1	1	3	2	1

UNIT-I INTRODUCTION
Engineering Geology-Minerals –Rocks- Soil formation- Major soil deposits of India-different types of soils-cohesive and cohesion less soils.
Clay Mineralogy and Soil Structure-basic structural units –Adsorbed water- soil structure

BASIC DEFINITIONS IN SOIL MECHANICS
Three Phase diagram of soil-Volume relations ships, weight relations ships, Mass/Weight volume relationship-Relative density. Index Properties of Soils-I.S. Classification of soils

UNIT-II PERMEABILITY
Soil water- capillary rise- flow of water through soils- Darcy's law- permeability- Factors affecting- laboratory determination of coefficient of permeability –Permeability of layered soil systems.

SEEPAGE THROUGH SOILS
Total, neutral and effective stresses –quick sand condition-Seepage through soils

COMPACTION
Mechanism of compaction-factors affecting-effects of compaction on soil properties.

UNIT-III SHEAR STRENGTH OF SOILS

Mohr- Coulomb Failure theories- Types of laboratory strength tests- strength tests based on drainageconditions-Shear strength of sands-Critical Void Ratio-Liquefaction- shear strength of clays.

UNIT –IV STRESS DISTRIBUTION IN SOILS

Boussinesq's and Westergaard's theories for point loads and areas of different shapes-Newmark's influencechart.

CONSOLIDATION

Stress history of clay; e-p and e-log p curves-magnitude and rate of 1-D consolidation-Terzaghi's Theory.Time rate of consolidation and settlement calculations.

UNIT-V

SOIL EXPLORATION

Need of Soil investigation-Sub Surface exploration-Depth of exploration-Methods of exploration (Openexcavation and Boring methods)-Types of soil samples.

SHALLOW FOUNDATIONS

Types-choice of foundation-Location of depth-Safe Bearing Capacity-Terzaghi`s, Meyerhoff's, IS CodeMethod- Settlement Analysis.

UNIT-VI DEEP FOUNDATIONS

Types of Deep foundations -Types of piles-Load carrying capacity of piles based on static pile formulae-Dynamic pile formulae –Negative Skin Friction-Load carrying capacity of pile groups.

TEXT BOOKS

1. Basic and Applied Soil Mechanics, Gopal Ranjan & ASR Rao, New age International Pvt. Ltd, NewDelhi, 2020.
2. An Introduction to Geotechnical Engineering, Robert D Hodtz, Pearson Education India, 2020.

REFERENCES

1. Soil Mechanics, T.W. Lambe and Whitman, Wiley India Pvt Ltd, 2020.
2. Principles of Geotechnical Engineering, Braja. M. Das & Khaled Sobhan, Cengage Publications, NewDelhi, 2020.
3. Soil Mechanics and Foundation Engineering, P. Purushotham Raj, edition 10th, Pearson Publishers,2020.
4. Geotechnical Engineering, Gulati S. K & Manoj Dutta, Tata M.C. Graw hill Publishers New Delhi,2020.
5. Modern Geotechnical Engineering, Alam Singh, CBS Publishers & Distributors, 2020.
6. Geotechnical Engineering, V.N.S. Murthy, CRC Press, New York, 2020.
7. Soil Mechanics and Foundation, B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi,publications Pvt. Ltd., New Delhi, 2020.
8. Soil Mechanics and Foundation Eng., K.R. Arora, 15th edition, Standard Publishers and Distributors,Delhi, 2021.
9. Geotechnical Engineering, C. Venkataramiah, 15th edition, new age International Pvt. Ltd, 2021.

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(A0112205) GEOINFORMATICS
(Open Elective-I)

COURSE OBJECTIVES:
- This is an introductory based course on Remote Sensing and GIS. The main goal of this course is to impart the core principles and basic techniques of Remote sensing and Geographic Information Systems (GIS). The GIS has emerged as a generic tool that has applications touching upon all disciplines of Civil Engineering as well as all aspects of life.
- Finally, students can understand the various engineering applications of remote sensing and GIS. Therapid progress and increased visibility of remote sensing and GIS since the 1990s has been made possible by a paradigm shift in computer technology, computer science and software engineering., as well as airborne and space observation technologies.

COURSE OUTCOMES:
At the end of the course student is able to:
- Understand the geometry of aerial photographs and use of digital photogrammetry in solvingengineering problems.
- Know the basics of remote sensing, understand electromagnetic radiation interaction and variousfundamental image processing routines.
- Basic knowledge of GIS terminology, components and frame work.
- Understand and analyze geospatial analysis techniques for better results.
- Apply Remote Sensing & GIS applications to solve various real-world problems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	3	2			1	1	1						1	1	
CO2	3	2			2		1						1	1	
CO3	3	2	1										1	1	
CO4		3	1		1								1	1	
CO5			2	3	2		2				2		1	1	
Avg.	3	2	1	3	2	1	1				2		1	1	

UNIT–I INTRODUCTION TO PHOTOGRAMMETRY
Principle and types of aerial photographs, Scales, Maps, Map Projections, Coordinate Systems, Stereoscopy, Ground control, Parallax measurements for height, determinations.

UNIT–II REMOTE SENSING
Basic concepts and foundation of remote sensing-elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolutions, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, introduction to Digital Image Processing.

UNIT–III GEOGRAPHIC INFORMATION SYSTEM
Introduction, GIS definition and terminology, GIS Categories, Components of GIS, Fundamental Operations of GIS, A Theoretical Framework for GIS. Introduction to Global Positioning System (GPS).

UNIT–IV TYPES OF DATA REPRESENTATION
Data collection and input overview, data input and output. Keyboard entry and Coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS-File

management, Spatial data-Layer based GIS, Feature based GIS mapping.

UNIT–V GIS SPATIAL ANALYSIS

Introduction, geospatial data analysis, integration and modeling of spatial data, geospatial data analysis methods, database query, geospatial measurements, overlay operations, network analysis, surface analysis, Geo-statistics, Geo-visualization.

UNIT–VI REMOTE SENSING & GIS APPLICATIONS

Flood management; Reservoir sedimentation; Geomorphology; Monitoring urban growth; Military operations; Watershed management, Satellite surveillance for drought conditions; Estimating Forest cover, Water resources management, Land use/Land cover-changes and mapping; Agriculture-crop type mapping, monitoring and damage assessment; Ground Water Targeting, Identification of sites for artificial Recharge structures.

TEXT BOOKS

1. Remote Sensing and GIS by B. Bhatta, Oxford University Press, New Delhi, 2020.
2. Remote sensing and GIS by M. Anji Reddy, B.S. Publications, New Delhi, 2020.

REFERENCES

1. Principals of Geographical Information Systems-Peter A Burragh and Rachael Mc Donnell, OxfordPublishers, 2020.
2. Remote Sensing and Image Interpretation by Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman,John Wiley & Sons Publications, 2020.
3. Remote Sensing and its applications by LRA Narayana University Press, 2020.
4. Advanced surveying: Total station GIS and remote sensing-Satheesh Gopi-Pearson publication,2020.
5. Geographical Information Science, Narayana Panigrahi, University press, New Delhi, 2020.
6. GIS by Kang-Tsung Chang, TMH Publications & Co., 2021.
7. Basics of Remote sensing & GIS S.Kumar, Laxmi Publications, 2021.
8. Geoinformation for Development by Zeil/Kienberger (Eds)-Univ. Science Press, New Delhi, 2020.

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(A0113205) SMART CITIES
(Open Elective-I)

COURSE OBJECTIVES:
- To understand the concept of smart city and associated challenges.
- To understand latest technologies used in intelligent building.
- To understand process of planning and drafting a plan for smart city.
- To understand the importance of different smart system.

COURSE OUTCOMES:
At the end of the course, the student will be able to
- Understand the necessity of infrastructural development for smart cities.
- Identify components of infrastructure and Prepare infrastructure plan for smart city.
- Understand smart transport system for smart cities and its application
- Study of water resources systems for smart city and its application.
- Understand National and Global policies to implement for smart city development.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					2	2	2	2	2	2	2	2			
CO2					2	2	2	2	2	2	2	2			
CO3					2	2	2	2	2	2	2	2			
CO4					2	2	2	2	2	2	2	2			

UNIT–I FUNDAMENTAL OF SMART CITY & INFRASTRUCTURE
Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smartcity world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment.

UNIT–II PLANNING AND DEVELOPMENT OF SMART CITY INFRASTRUCTURE
Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.

UNIT–III INTELLIGENT TRANSPORT SYSTEMS
Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing.

UNIT–IV MANAGEMENT OF WATER RESOURCES AND RELATED INFRASTRUCTURE
Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.

UNIT–V INFRASTRUCTURE MANAGEMENT SYSTEM & POLICY FOR SMART CITY
Integrated infrastructure management systems for smart city, Infrastructure management systemapplications for existing smart city. Worldwide policies for smart city.
Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.

UNIT–VI GREEN BUILDING IN SMART CITIES
Introduction to green buildings, Rating system, Energy saving system.

TEXT BOOKS

1. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li, 2020.
2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos, 2020.

REFERENCE BOOKS

1. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend, 2020.
2. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 2020.
3. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 2020.
4. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers. "Smart cities-Ranking of European medium-sized cities". Smart Cities. Vienna: Center of Regional Science, 2020.
5. Mission statement & guidelines on Smart City Scheme. Government of India-Ministry of Urban Development
   http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines.pdf

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(A0114205) ROAD SAFETY AUDIT
(Open Elective-I)

COURSE OBJECTIVES:

- The main objective is to develop highway professionals as Road Safety Auditors who should be able to bring-insafety engineering elements in planning, design, construction, operation and maintenance stages systematically ensuring safety for the road users. They will also be used for the network in operation for identifying safety deficiencies and to suggest improvements based on thorough analysis & audit.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Study feasibility of the Indian National Highways
- Study the accident scenario in India
- Learn the checklist of the different stages of the road constructions
- Learn the audit process of different organizations.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	2	2													
CO3	2														
CO4	2														

UNIT-I ROAD SAFETY SITUATION IN INDIA

General-Road safety situation in India, Accident Prevention, Road safety Audit-Part of Road SafetyStrategy.

UNIT-II ROAD SAFETY AUDIT

Road Safety Audit and Quality Assurance, Why Road Safety Audit, Organizations involved in Road safetyAudit, Road safety Auditors and key Personnel in RSA.

UNIT-III STAGES OF ROAD SAFETY AUDIT

During Feasibility study, Completion of preliminary design, completion of detailed design, pre-opening.

UNIT-IV ROAD SAFETY AUDIT PROCESS

Selecting road safety audit team, Providing the background information, Assessing the documents,inspecting the team, Holding a completion meeting.

UNIT-V SALIENT FEATURES AND PRINCIPLES FOR SAFE ROAD DESIGN

Principles of Road safety, Special safety issues related to road design, Design Context, Access control,Tress, Road signs, Sight distance, Parked vehicle

UNIT-VI SAFETY AUDIT PROCESS IN RURAL ROADS

Context, Safety Aspects in Rural Roads, Safety Audit- Project to be audited, Audit Team, Stages of safetyaudit, Audit process, Check Lists

REFERRENCE BOOK

1) Road Safety Audit by IRC: SP:88:2010

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(A0115205) BUILDING INFORMATION MODELLING
(Open Elective-I)

COURSE OBJECTIVES:

- Building Information Modelling (BIM) is argued to be a catalyst for change poised to reduce industry's fragmentation, improve its efficiency, effectiveness and lower the high costs of inadequate interoperability.
- To demonstrate how construction management functions are impacted by new technologies and helps students understand the fundamentals and practical uses of the state-of-the-art information technologies and tools in the building industry. It also promotes project-based learning through cross-disciplinary, geographically distributed, and virtual project team collaboration

COURSE OUTCOMES:

At the end of the course student are able to:

- Improve Collaboration
- Resolve Conflict
- Apply the Software Tools, for analysis & designing of models
- Promotes project-based learning through cross-disciplinary.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	2	2	1	2	2	2	3	2	2	2
CO2	3	2	3	3	3	2	2	1	2	2	2	3	2	2	2
CO3	3	2	3	3	3	2	2	1	2	2	2	3	2	2	2
CO4	3	2	3	2	3	2	2	1	2	2	2	3	2	2	2

UNIT I INTRODUCTION

Introduction, The Settings for BIM, Current Practice, Legal Considerations

UNIT II BIM STAGES

Building Information Modeling, Introduction, BIM Concepts, BIM Planning, BIM Implementation

UNIT III BIM TOOLS

Software Tools, Introduction, Modeling Tools, Model Analysis, Specific Software Options

UNIT IV LEARNING BIM

Learning BIM, Introduction, Learning Methods, Skill Set, The learners

UNIT V CASE STUDIES OF BIM

Case Studies, DPR Construction, RQ Construction,

UNIT VI CASE STUDIES

Case Studies

TEXT BOOKS

1. Turner Construction, Seattle, Washington, Gregory P. Luth & Assoc. Inc, Webcor Builders, 2021.
2. Building Information Modeling Technology Foundations and Industry Practice, Andrew Borrman,Markus Konig, Christian Koch, Spinger, 2021.

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(A0116205) ADVANCED STRUCTURAL ANALYSIS
(Professional Elective-I)

Prerequisites: Strength of Materials, Structural Analysis.

COURSE OBJECTIVES:
- To analyze continuous beams, portal frames, arches using various methods.

COURSE OUTCOMES:
At the end of the course student is able to
- Analyze two hinge and three hinged arches
- Analyze continuous beams using plastic analysis
- Analyze frames using flexibility, stiffness, and approximate methods
- Apply strain energy method for beams and frames

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	1	-	2	-	1	2	-	1	3	2	-
CO2	2	3	1	-	1	-	2	-	1	1	-	1	3	2	-
CO3	2	3	1	-	1	-	2	-	1	1	-	1	3	2	-
CO4	3	3	1	-	1	-	2	-	1	2	-	1	3	2	-

UNIT-I ARCHES

THREE HINGED ARCHES
Elastic theory of arches-Eddy's theorem-Determination of horizontal thrust, bending moment, normal thrustand radial shear-effect of temperature.

TWO HINGED ARCHES
Determination of horizontal thrust, bending moment, normal thrust and radial shear- Rib shortening andtemperature stresses, tied arches-fixed arches

UNIT-II STRAIN ENERGY METHOD
Application to the analysis of continuous beams and simple portal frames.

UNIT-III PLASTIC ANALYSIS
Introduction-Idealized stress-Strain diagram-shape factors for various sections-Moment curvature relationship-ultimate moment-Plastic hinge-lower and upper bound theorems-ultimate strength of fixed and continuous beams.

UNIT-IV FLEXIBILITY METHOD
Introduction to the structural analysis by flexibility concept using Matrix approach and application to beams andportal frames.

UNIT-V STIFFNESS METHOD
Introduction to the structural analysis by stiffness concept using Matrix approach and application to beams andportal frames.

UNIT-VI APPROXIMATE METHODS
Analysis of building frames using portal frame method, cantilever method.

TEXT BOOKS
1. Structural Analysis (Vol-1&II), Bhavikatti S.S., Vikas Publishing House, India,2020.
2. Structural Analysis (Vol-1&II), Vaidyanathan R., and Perumal., Laxmi Publications (pvt) Limited,India, 2020.

REFERENCE BOOKS

1. Structural Analysis, Negi L.S., Jangid R.S., Tata Mcgraw Hill Publishing Co Ltd, New Delhi, 2020.
2. Structural Analysis, Hibbeler, R.C., 10th edition, Pearson, India, 2020.
3. Intermediate Structural Analysis, Wang C.K., Tata McGraw Hill Publishing Co Ltd, New Delhi, 2020.
4. Theory of structures, Ramamrutham S., Narayan R., 12th edition, Dhanpat Rai Publishing Co Ltd,India, 2020.
5. Structural Analysis, Devdas Menon, Narosa Publishing House, India, 2020.

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(A0117205) OPEN CHANNEL HYDRAULICS
(Professional Elective-I)

COURSE OBJECTIVES:

- This course finds application in the solution of problems related to several aspects of development of surface water resources. Problems in a wide variety of fields, such as the design of hydraulic structures, dispersion of pollutants, overland flow and sediment transport in rivers require the use of principles of open-channel flow.

COURSE OUTCOMES:

At the end of the course student is able to

- Understand the open channel characteristics including hydraulic jump and transitions
- Get the knowledge about gradually and rapidly varied open channel flows.
- Analyze the flow characteristics in open channels
- Analyze the flow profiles using GVF Computation methods.
- Solve the hydraulic jump problems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											1	2	1
CO2	3	1											1	2	1
CO3	1	3	2										1	2	1
CO4	1	3	2										1	2	2
CO5	1	3	1										1	2	2

UNIT-I INTRODUCTION

Difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, kinetic energy and momentum factors.

UNIT-II UNIFORM FLOW

Concepts, uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels foruniform flow.

UNIT-III CRITICAL FLOW

Concept of specific energy, Classification of flow, design of channel, Section factor, Hydraulic exponent for critical flow, critical depth as a flow measurement.

UNIT-IV GRADUALLY VARIED FLOW

Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification. Analysis of flow profiles, Method of singular point and transitional depth, methods of computation, practical problems.

UNIT-V GVF COMPUTATIONS

Different methods, direct integration method, Bress's solution, Chow's solution, direct method, standard step method.

UNIT-VI RAPIDLY VARIED FLOW

Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of jump-length, location and height, Stilling basins, shape type-2 and type-4, Hydraulic jump in - rectangular sloping channels, non-rectangular channels; application of hydraulic jump as energy dissipater.

TEXT BOOKS

1 Flow through open channel: Rangaraju R G, Tata McGraw Hill, 10th edition, Publishing Co Ltd, NewDelhi, 2020.

2 Open Channel Hydraulics: Subramanya K, Tata McGraw Hill, 12th edition, Publishing Co Ltd, NewDelhi, 2021.

REFERENCE BOOKS

1 Chow Ven Te: Open Channel Hydraulics, McGraw Hill Book Company, New Delhi, 2020.
2 French: Open Channel Hydraulics, McGraw Hill Book Company, New Delhi, 2020.
3 Fluid Mechanics: Modi and Seth, Standard House, New Delhi, 2020.
4 Open Channel Hydraulics: Henderson, Mr. Millan Publishing Co. Ltd, New Delhi, 2020.

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(A0118205) ADVANCED LAND MEASUREMENT TECHNIQUES
(Professional Elective-I)

COURSE OBJECTIVES:

- This course exposes students to some of the advanced methods of land measurement. The course will prepare students to design and execute larger projects where mapping is an essential component using much advanced technologies. Further, it will help them see the research frontiers in land measurement.

COURSE OUTCOMES:

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

- Understand GPS range and time measurements, errors, surveying methodologies and field procedures
- Knowing the idea on Laser properties and methods of range measurements.
- Understand the components of LiDAR systems and INS-GPS integration.
- Understand the fundamental concepts of Photogrammetry.
- Understand the interior and exterior orientation, mathematical model relating image and object space.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	3	2			3								3	2	1
CO2	3	2			3								3	2	1
CO3	3	2			3								3	2	1
CO4	3	2			3								3	2	1
CO5	3	2			3								3	2	1
Avg.	3	2			3								3	2	1

UNIT- I GPS BASIC CONCEPTS

Pseudo range and carrier phase measurements; GPS coordinate systems- WGS-84, GPS time. GPS Errors: Errors and biases in GPS- timing, orbital, ionospheric and tropospheric effects; Ambiguity resolution; Cycle slips, Multipath and other observational errors.

UNIT-II GPS SURVEYING PROCEDURES

Surveying with GPS- point positioning, relative positioning, static and kinematic positioning, Planning and field observations- networking. Laser physics: spectral characteristics of laser, laser interaction with objects.

UNIT-III GNSS (GLOBAL NAVIGATION SATELLITE SYSTEM)

Data collection methods, DGPS, Errors in observations and corrections, principles used, Components of GNSS.

UNIT-IV MEASUREMENT OF LASER RANGE

CW and pulse method, laser pulse, energy, pulse width and related definitions; LiDAR equation and related physics.

UNIT-V LASER APPLICATIONS

DEM generation algorithms and introduction to other applications. Photogrammetry: Metric and non-metric cameras; Geometry of near vertical and tilted photographs, heights and tilt distortions; Rectification and orthophotographs.

UNIT-VI MEASUREMENTS FOR HEIGHT DETERMINATION

Stereoscopy, parallax equation and stereo measurements for height determination, Orientation interior, exterior, relative, and absolute; Mathematical model relating image, model and object space; Collinearity and coplanarity conditions, Bundle block triangulation.

TEXT BOOKS

1. GPS Satellite Surveying, Alfred Leick, John Wiley, 2020.
2. Elements of Photogrammetry, Wolf, Paul, R. Second Ed., McGraw-Hill, 2020.

REFERENCES

1. GPS for Land Surveyors, Sickle, J. V. Ann Arbor Press, 2020.
2. Digital elevation model technologies and applications, David F. Maune the DEM user's manual;Manual of Remote Sensing: ASPRS; 2020.
3. Airborne and Terrestrial laser scanning, George Vosselman and Hans-Gerd Maas, CRC Press, NewYork, 2020.
4. Topographic laser ranging and scanning: principle and processing, Jie Shan and Charles K Toth, CRCPress, New York, 2020.
5. Photogrammetry, Moffit, Francis H. and Mikhail, Edward M. Third Ed., New York: Harper& Row,2020.

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(A0119205) EXPERIMENTAL STRESS ANALYSIS
(Professional Elective-I)

Prerequisites: Strength of Materials and Mathematical Methods.

COURSE OBJECTIVES:

- Discusses the various experimental techniques like photo elasticity, strain gauges, brittle coatings etc. for theanalysis of problems

COURSE OUTCOMES:

At the end of the course student is able to:

- Apply principles of elasticity theory to determine stresses and strains
- Apply theory of elasticity and formulate plane stress and plane strain problems
- Apply experimental techniques using strain gauges to solve field problems
- Understand the concept and application of NDT techniques
- Understand the concept of brittle coating methods and photo-elasticity
- Determine the stresses using strain rosette concept

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	---	---	---	1	---	1	1	---	---	1	1	1
CO2	2	2	2	---	---	---	1	---	1	1	---	---	1	1	1
CO3	2	3	3	2	---	---	1	---	1	1	---	---	1	1	1
CO4	3	3	3	2	2	---	1	---	1	1	---	---	1	1	1
CO5	2	3	2	---	2	---	1	---	1	1	---	---	1	1	1
CO6	3	1	2	---	2	---	1	---	1	1	---	---	1	1	1

UNIT-I PRINCIPLES OF EXPERIMENTAL APPROACH

Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods-Simplification of problems.

UNIT-II STRAIN MEASUREMENT USING STRAIN GAUGES

Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain-Gauge Systems-Types of Strain Gauges-Mechanical, Acoustic and Optical Strain Gauges.

UNIT-III

ELECTRICAL STRAIN GAUGES

Inductance strain gauges-LVDT-Resistance strain gauges-various types-Gauge factor-Materials of adhesion base etc.

STRAIN ROSETTES

Introduction-Three element Rectangular Rosette-The Delta Rosette Corrections for Transverse Strain Gauge.

UNIT-IV

NON-DESTRUCTIVE TESTING

Ultrasonic Pulse Velocity method-Application to Concrete-Schmidt hammer Test Application to Concrete.

BRITTLE COATING METHODS

Introduction-Coating Stress-Failure Theories-Brittle Coating Crack Patterns-Crack Detection-Types of Brittle Coating-Test Procedures for Brittle Coating Analysis-Calibration Procedures-Analysis of Brittle Coating Data.

UNIT-V THEORY OF PHOTOELASTICITY

Introduction-Temporary Double refraction-The stress Optic Law-Effects of stressed model in a polariscopefor various arrangements-Fringe Sharpening. Brewster's Stress Optic law.

UNIT-VI TWO-DIMENSIONAL PHOTOELASTICITY

Introduction-Iso-chromic Fringe patterns-Isoclinic Fringe patterns passage of light through plane Polariscopeand Circular polariscope Isoclinic Fringe patterns-Compensation techniques-Calibration methods-Separation methods-Scaling Model to prototype Stresses-Materials for photo-Elasticity Properties of Photoelastic Materials.

TEXT BOOKS

1. Experimental stress analysis, J.W.Dally and W.F.Riley, Printice Hall of India, New Delhi, 2020.
2. Experimental stress analysis, Sadhu Singh, Tata Mc.Graw Hill, New Delhi, 2020.

REFERENCE BOOKS

1. Experimental stress analysis, Vazrani and Ratwani, Laxmi, publications Pvt. Ltd., New Delhi, 2020.

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(A0120205) CONSTRUCTION TECHNOLOGY AND PLANNING MANAGEMENT
(Skill Development Course)

COURSE OBJECTIVES:

- Objectives, need, functions, types, resources and stages of project management.
- PERT-CPM network formulation and analysis
- Types- documentation- procedures of tenders
- Causes- classification- accident report- safety measures

COURSE OUTCOMES:

At the end of the course student is able to:

- Understand the methods of planning, scheduling and principles of construction management.
- Formulate, solve CPM&PERT networks.
- Understand the concepts of quality control and safety management.
- Understand the procedure of documentation of tenders, contracts & time-cost analysis

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2									2	3				1
CO2	2	2								2	3				1
CO3	2									2	2				1
CO4	2								2	2	2				

UNIT-I PROJECT MANAGEMENT

Introduction, Project planning, Scheduling, Controlling, Role of Project Manager

UNIT-II DEVELOP OF BAR CHARTS

Illustrative examples, Shortcomings of bar charts and remedial measures, Milestone charts, Development of PERT network Problems

UNIT-III

ELEMENTS OF NETWORK

Introduction, Event, Activity, Dummy, Network rules, Graphical guidelines for network, Common partial situations in network.

DEVELOPMENT OF NETWORK

Planning for network construction-Modes of network construction-Steps in development of network-Work breakdown structure

UNIT-IV PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT)

Introduction, Time estimates-Frequency distribution-Mean, variance and standard deviation, earliest expected time-Formulation for TE - Latest allowable occurrence time-Formulation for TL - Combined tabular computations for TE and TL problems.

UNIT-V PERT AND CPM (NETWORK ANALYSIS)

Introduction, Slack, Critical path, CPM-Networks, Activity time estimate, Earliest event time, Latest allowable occurrence time, combined tabular computations for TE and TL, Start and finish times of activity, Float-Critical activities and critical path problems.

UNIT-VI TENDERS

Type of tenders, Principles of tendering-Notice inviting tender**.**

CONSTRUCTION SAFETY MANAGEMENT

Importance of safety, Causes, Classification, Measurement, cost of accidents, Accident report, General safety programs, and Safety measures for different construction works.

TEXT BOOKS

1 Project Planning & Control- with PERT & CPM, Dr. B.C. Punmia & K.K. Kandelwal, 10th edition, 2020.
2 Construction Management and Accounts, J.L. Sharma - Satya Prakasan, 2020.

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(A0195205) CAD LAB

PREREQUISITES: None.

COURSE OBJECTIVES:

- The course objective of this Lab consists of Analysis & design of fixed beam, continuous beam, plane frame,and space frame, one-way and two-way slabs, roof truss, isolated column footing. retaining wall.

COURSE OUTCOMES:

At the end of the course student is able to:

- Know application of various software to model the structure in Civil Engineering domain.
- Understand the usage of software commands.
- Analyze the structural elements / structures.
- Evaluate and estimate the reinforcement required to the structural elements.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3		3					1			3	1	1
CO2	1	3	3		3					1			3	1	1
CO3	1	3	3		3					1			3	1	1
CO4	1	3	3		3					1			3	1	1

EXPERIMENTS

1. Analysis & design of fixed beam.
2. Analysis & design of continuous beam
3. Analysis & design of plane frame +
4. Analysis and design of space frame
5. Analysis of roof truss.
6. Design of one-way slabs.
7. Design of two-way slabs.
8. Design of isolated column footing.
9. Design of retaining wall.

SOFTWARE: Using STAAD Pro or STRUDS or STRAP etc.

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(A0196205) GEOTECHNICAL ENGINEERING LAB

COURSE OBJECTIVES:

- Provide hands on experience in using various geotechnical lab equipment.
- Provides knowledge in determining the properties of soil using IS standards.

COURSE OUTCOMES:

At the end of the course student is able to:

- Determine the various properties of soil like index properties and classify soil
- Determine engineering properties of soil like coefficient of permeability, consolidation parameters andinterpret the results for the given soil.
- Determine engineering properties of soil from laboratory (shear parameters) and field tests.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-		1	1	1	3	2	-	1	2	2	3
CO2	1	-	-	-		1	1	1	3	2	-	1	2	2	3
CO3	1	-	-	-		1	1	1	3	2	-	1	2	2	3

LIST OF EXPERIMENTS

1. Grain size analysis
2. Atterberg's Limits
3. Compaction test
4. Field density-core cutter and sand replacement method
5. Permeability of soil, constant and variable head test
6. CBR Test
7. Consolidation test
8. Unconfined compression test
9. Vane shear test
10. Direct shear test
11. Tri-axial Compression test
12. SPT Test

TEXT BOOKS

1. K.V.S. Appa Rao &V.C.C. Rao, Soil Testing Lab Manual, University Science Press, LaxmiPublication, 2016.
2. S. Mittal and J.P. Shukla, Soil Testing for Engineers, Khanna Publishers, New Delhi, 2008.

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(A0121206) DESIGN OF STEEL STRUCTURAL ELEMENTS

Prerequisites: Mechanics of Materials.

COURSE OBJECTIVES:

- Design principles of steel structures are essential for Civil Engineers for any fabrication of structure such as Industrial sheds, bridges, trusses etc. This course provides the thorough knowledge of different design specifications of steel structures using respective IS 800-2007.

COURSE OUTCOMES:

At the end of the course student is able to:

- Design of bolt and welded connection.
- Design of tension and compression member.
- Design of gusseted base, column base and slab base.
- Design of plate girder.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	-	2	-	-	-	-	-	-	2	3	2	-
CO2	3	1	3	-	2	-	-	3	-	-	-	2	3	2	-
CO3	3	1	3	-	2	-	-	-	-	-	-	2	3	2	-
CO4	3	1	3	-	2	-	-	3	-	-	-	2	3	2	-

UNIT-I

INTRODUCTION: General - Types of Steel-Mechanical behavior of steel –Types of Structural Steel Sections. Design of Steel fasteners: Types of fasteners-Riveted connections-Bolted connections- Assumptions- Failure of bolted joints
– Strength of bolted joints- Design examples- Design of Welded connections- Butt weld-fillet weld- Design examples

UNIT-II

DESIGN OF TENSION MEMBERS: General-Modes of Failure of Tension member-Analysis of Tension members- Example - Design steps-Design examples-Lug angles.

UNIT-III

DESIGN OF COMPRESSION MEMBERS: General-Strength of Compression members-Design Compressive strength- Example on analysis of Compression members-Design of Angle struts-Design Examples- Built up Columns- Design of Lacing-Design of Battens- Design Examples.

UNIT-IV

DESIGN OF COLUMN BASE: Design of Column Base- Slab Base - Gusseted Base- Design Examples.

UNIT-V

DESIGN OF ROOF TRUSSES: Various types of trusses and their selection, effect of wind loads on purlin and trusses-Design of purlin and elements of truss.

UNIT-VI

DESIGN OF PLATE GIRDER: General- Components of Plate Girder- Optimum depth-Bending Strength-Shear Strength-Shear Buckling- Simple Post critical method- Tension Field method- Stiffeners-Bearing- Transverse stiffeners - Design Examples

NOTE: IS 800-2007 and Steel Tables are permitted for examination.

TEXT BOOKS

1. Design of Steel Structures, S.K. Duggal, Tata McGraw Hill, 12th edition, New Delhi, 2021.
2. Design of Steel Structures, N. Subramanian, 12th edition, Oxford Publishers, New Delhi, 2021.

REFERENCE BOOKS

1. Design of Steel Structures, Arya and Azmani, PHI Publishers, New Delhi, 2020.

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(A0122206) ENVIRONMENTAL ENGINEERING

COURSE OBJECTIVES:
- To protect human against environmental factors and to protect environment against human actions.
- This is one of such courses which motivates the students to learn different concepts of public water supply, water quality & Quantity and also different methods of purification for the water which is badin quality for drinking.
- They can also learn how to distribute treated water to the communities by maintaining sufficient requirements and also can be able to design it according the standards using different principles of hydraulics.
- To quickly drain waste water away from community (to prevent breakup of water borne diseases).
- To make waste water fit to dispose.
- Getting acquainted with physical, chemical and biological methods & possibilities of separation,recovery and deformation of various pollutants of gaseous and solid phase; basic processes and engineering equipment of the technology; characterization, collection and treatment, theoretical basics of burning solid wastes, typical equipment, solid waste disposal and recycling.

COURSE OUTCOMES:
At the end of the course student is able to:
- Forecast the water demand according to population, Analyze characteristics of water, understand and Analyze water quality testing and have knowledge about different source of water.
- Adopt and design suitable treatment technology to treat the raw water, and Analyze design thedistribution network using hydraulics.
- Identify the characteristics and quality of sewage and have knowledge about the waste water collectionsystem and design of sewers.
- Suggest and design suitable treatment methods to treat waste water and sludge based on their qualityand suitable methods for effluents disposals.
- Understand human interaction with the Environment and have knowledge about sources of pollutionand their effects on (human beings/Plants/Materials).
- Gain knowledge of controlling methods for Environmental Pollution (air/noise/hazardous waste) andhave knowledge about solid waste and hazardous waste and their collection and disposal.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	2	3	-	-	-	-	-	-	2	-
CO2	3	2	3	-	-	3	3	-	-	-	-	-	-	-	2
CO3	3	3	2	-	-	3	3	-	-	-	-	-	-	-	2
CO4	3	1	3	-	-	3	3	-	-	-	-	-	1	-	-
CO5	3	1	-	-	-	3	3	-	-	-	-	-	-	2	-
CO6	3	2	-	-	-	3	3	-	-	-	-	-	-	1	-

UNIT-I INTRODUCTION OF WATER SUPPLY ENGINEERING
Population Forecasting & Water Demands, Sources and Conveyance of Water, Surface Source of Water types, Sub Surface of Water types, Various types of Pressure pipes, Quality of Water, Physical Characteristics of water, Chemical Characteristics of water and Biological Characteristics of water, Water borne diseases.

UNIT-II TREATMENT OF WATER

Methods of Purification, Screening, Plain Sedimentation, Sedimentation aided with coagulation, Filtration, Disinfection, Aeration, Softening, Miscellaneous Water Treatment such as Fluoridation, Re-carbonation, Liming, Desalination etc…, Types of Sedimentation tanks , Slow sand filters , Rapid sand filters and pressure filters, Disinfection methods, Various forms of Chlorine, Types of Chlorination, Removal of temporary hardness of water and Removal of permanent hardness of water , Removal of colour, odour and taste, Fluoridation and De-fluoridation , Desalination, Designs of Distribution systems, Appurtenances in Distribution System.

UNIT-III INTRODUCTION OF WASTE WATER

Fundamental Definitions of Refuse, Garbage, Rubbish, Sewage, Sullage, Storm Water, Systems of Sewerage, Separate System, combined system and partially separate system Classification of sewers, House sewer, Lateral sewer, Trunk or Main sewer, Out fall sewer, Estimation of dry & wet weather flow, sewer materials.

UNIT-IV CHARACTERISTICS OF SEWAGE

Physical Characteristics of waste water, Turbidity, Colour, Odour, Temperature, Chemical Characteristics, Determination of solids, dissolved oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, BOD and COD Tests, BOD and COD ratio, Relative Stability, Population Equivalent.

UNIT-V TREATMENT OF SEWAGE

Preliminary Treatment, Primary Treatment, Secondary or Biological treatment and complete final treatment of waste water, grit chambers, detritus tanks, skimming tank, Activated Sludge process, Trickling filters, Sludge digestion, Septic Tanks, Oxidation Ponds and Disposal of Sewage Effluents.

UNIT-VI TYPES OF POLLUTION

Water pollution, land pollution, Air pollution, Noise pollution, Various methods of disposal refuse, Sources of air, water, land and noise pollution, Classification of air, water, land and noise pollution, Characteristics of air, water, land and noise pollution.

TEXT BOOKS

1) Water supply and sanitary engineering by Garg, 10th edition, 2020.
2) Elements of environmental engineering by K.N.Duggal, S Chand Publishers, 2020.
3) Water supply engineering vol 1, waste water engineering vol 2, B.C. Punmia, Ashok Jain &Arun Jain, Laxmi publications pvt.ltd. New Delhi, 2020.
4) Environmental engineering by Basak, Tata Mc. Graw Hill edition, New Delhi, 2020.
5) Environmental pollution control engineering by C.S.Rao, 2020.

REFERRENCE BOOKS

1) Water and waste water technology by Mark J Hammer and Mark J Hammer Jr., 2020.
2) Water and waste water technology by steel, 2020.
3) Water and waste water engineering by Fair Geyer and Okun, 2020.
4) Waste water engineering by Metcalf Eddy, 2020.
5) Physico - chemical process for water quality control by Weber, 2020.
6) Environmental engineering by Gerard kiely, Tata Mc. Graw Hill edition, New Delhi, 2020.
7) Air pollution and control by M.N. Rao & H.N. Rao, 2020.

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(A0123206) TRANSPORTATION ENGINEERING

COURSE OBJECTIVES:

- The course objective covers the traffic characteristics, traffic measurements, Highway capacity, parkingstudies, Traffic signs and road markings.

COURSE OUTCOMES:

At the end of the course student is able to:

- Carry out surveys involved in planning and high way alignment
- Determine the characteristics of pavement materials
- Design cross section elements, sight distance, horizontal and vertical alignment.
- Design flexible and rigid pavements as per IRC
- Understand the principles of construction and maintains of highway
- Implement traffic studies, traffic regulations and control, and Intersection Design.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				2								3		
CO2	3													3	
CO3	3	3	3											3	
CO4	3	3	3											3	
CO5	2										2			3	
CO6	3	2	3		2									3	

UNIT-I INTRODUCTION TO TRANSPORTATION ENGINEERING

Transportation as system, modes of transportation systems.

HIGHWAY ENGINEERING: Roads Development plans in India: Highway Alignment-Factors affecting Alignment-Engineering Surveys –Drawings and Reports.

HIGHWAY MATERIALS: Tests on Soil- CBR, Field CBR, modulus of sub-grade reaction, Tests on aggregates- Aggregate Impact test, Crushing Test, Los Angles Abrasion Test, Shape Test Tests on Bitumen-Ductility Test, Flash and fire point Test, Penetration Test, Softening point test Ductility Test, Marshall Stability test.

UNIT-II HIGHWAY GEOMETIC DESIGN

Importance of Geometric Design- Design controls and Criteria- Highway Cross section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance

UNIT-III DESIGN OF HORIZONTAL AND VERTICAL ALIGNMENT

Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical Alignment-Gradients-Vertical curves.

UNIT-IV FLEXIABLE PAVEMENT DESIGN

Types of pavements- Difference between flexible and rigid pavements. Pavement Components- Subgrade, Subbase, base and wearing course-Functions of pavement components. Design Factors-Flexible pavement. Design methods-G.I method, CBR Method, IRC: 37-2018 -Guidelines for the design of flexible pavement.

UNIT-V RIGID PAVEMENT DESIGN

Design of Rigid pavements-Critical load positions -Westergaard's stress equations-computing Radius of Relative stiffness and equivalent radius of resisting section-stresses in rigid pavements-Design of Expansion and contraction joints in CC pavements. Design of Dowel bars and Tie bars. Introduction to IRC: 58-2015 method of plain jointed rigid pavement Design.

UNIT-VI HIGHWAY CONSTRUCTION

Construction of Earth Roads- Gravel Roads-WBM Roads - Bituminous Pavements - Cement Concrete Roads - Steps in Construction-Reinforced Concrete Pavements –Soil Stabilization– Methods and Objectives-Soil-cement Stabilization and Soil- lime Stabilization.

TEXT BOOKS

1. Highway Engineering-S.K. Khanna & C.E.G. Justo, Nemchand & Bros, 10th Edition., 2021.
2. Transportation Engineering-Introduction - C. Jotin Khisty and B. Kent Lall, 3rd Edition. Prentice HallIndia, 2021.

REFERENCE BOOKS

1. Principles of Transportation Engineering-Chakraborty Partha and Animesh Das, 2nd Edition; Prentice HallIndia, 2020.
2. IRC: 37-2018-Guidelines for Design of Flexible Pavements; (4th Revision) Indian Road Congress, NewDelhi.
3. IRC: 58-2015-Guidelines for Design of Plain Jointed Rigid Pavements; (4th Revision) Indian RoadCongress, New Delhi.
4. IS:73-2013, Paving Bitumen - Specification, Bureau of Indian Standards, New Delhi.

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(A0124206) MAINTENANCE AND REPAIR OF BUILDINGS
(Open Elective-II)

COURSE OBJECTIVES:
- Provides insight into various maintenance & repair techniques

COURSE OUTCOMES:
At the end of the course, student is able to:
- Understand the reasons for distress in structure and will be able to suggest suitable solutions.
- Understand properties of different building materials. And able to suggest the proper maintenance orrepair technique to suit the situation.
- Basic knowledge of using modern tools in maintenance process.
- Understand long-term durability characteristics of structures.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	3	1	2										2		2
CO2	2	1	1		2								2		2
CO3	2	1	1		2		2						2		2
CO4	2	1			2							2	2		2
Avg.	2	1	2		2		2					2	2		2

UNIT-I INTRODUCTION
Deterioration of Structures-Distress in Structures-Causes and Prevention. Mechanism of Damage-Types ofDamage.

UNIT-II PERFORMANCE OF BUILDING MATERIALS IN SERVICE
Maintenance philosophy-phases of maintenance-routine preventive and curative maintenance-methods, specification and cost analysis- common defects in buildings and measures to prevent and control the same- Building failures- causes and effects- cracks in buildings- types, classification & investigation.

UNIT-III INSPECTION AND TESTING
Symptoms and Diagnosis of Distress -Damage Assessment - NDT-RCPT –PUDIT.

UNIT-IV TECHNIQUES FOR REPAIR
Surface repair-material selection-surface preparation –rust eliminators and polymers - coating for rebar during repair-repair of cracks in concrete and masonry-methods of repair- epoxy injection, mortar repair for cracks- gunitinig and shotcreting- Water proofing of concrete roofs.

UNIT-V STRENGTHENING MEASURES
Flexural strengthening, beam shear capacity strengthening, column strengthening, shorting, under pinning and jacketing- Conservation movement- materials and methods for conservation work-examples.

UNIT-VI HEALTH MONITORING OF STRUCTURES
Use of Sensors-Building Instrumentation.

TEXT BOOKS
1. Repair & Rehabilitation and Minor Works of Buildings, P.C. Varghese -Maintenance, PHI, 2020.
2. Deterioration, Maintenance and Repair of Structures, Sidney M. Johnson- Mc Graw Hill, 2020.

REFERENCES

1. B.L. Gupta and Amit Gupta- Maintenance and Repair of Civil Structures, 10th edition,- StandardPublications, 2020.
2. Failure and Repair of Concrete Structures, Champion.S, 2020.
3. Concrete Repair and Maintenance, Peter H. Emmons - Galgotia Publishers, 2020.
4. Building Failures, Mckaig T.M.-Applied Science Publications, 2020.
5. Concrete Structures - Repair, Water Proofing and Protection, Philip. H. Perkins, 2020.
6. Durable Structures- Through Planning for Preventive Maintenance, Raikar- - R and D Center StructuralDesigners and Consultants Pvt Ltd, Vashi, New Bombay, 2020.

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(A0151207) SOIL DYNAMICS AND MACHINE FOUNDATIONS
(Open Elective-II)

COURSE OBJECTIVES:
- Provide knowledge in vibrations, vibration of soil system, field and laboratory determination of dynamic soil properties.
- Provide knowledge about machine foundations like reciprocating & impact machines, vibration isolation.

COURSE OUTCOMES:
At the end of the course student is able to:
- Understand vibration systems and find the dynamic soil properties
- Find the dynamic soil properties
- Understand & Design vibration isolation.
- Understand, design & execute the machine foundations.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		2								2	1	
CO2	3	3	3										2	1	1
CO3	3	3	3		2								2	1	
CO4	3	3	3		2								2	1	
Avg.	3	3	3		2								2	1	1

UNIT-I
Theory of vibrations: Basic definitions- free and forced vibrations with and without damping for single degree freedom system- Resonance and its effect-magnification-Logarithmic decrement-Transmissibility

UNIT-II
Natural frequency of foundation-Soil system: Barkan's and IS methods-pressure bulb concept-Pauw's Analogy.
Wave propagation: Elastic waves in Rods-Waves in elastic Half space.

UNIT-III
Dynamic Soil Properties: Field and Laboratory methods of determination-Up hole, Down hole and cross hole methods-Cyclic plate load test-Block vibration test-Determination of Damping factor.

UNIT-IV
Machine Foundations: Types, Design criteria, permissible amplitudes and bearing pressure.
Block foundation: Degrees of freedom - analysis under different modes of vibration

UNIT-V
Analysis of Two Degree freedom systems under free and forced vibrations -Principles of Design of Foundations for reciprocating and impact machines as per IS code.

UNIT-VI
Vibration Isolation: Types and methods-Isolating materials and their properties

TEXT BOOKS:
1. Handbook of Machine Foundations by P.Srinivasulu and G.V.Vaidyanathan, Tata McGraw Hill
2. Soil Dynamics by Shamsher Prakash

REFERENCES:

1. Dynamics of Bases and Foundations by Barken, McGraw Hill Publishing Co.,New York
2. Vibration of Soils and Foundations by Richart, Hall and Woods, Prentice Hall, eaglewood Cliffs, New Jersy, USA.

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(A0152207) GROUND WATER DEVELOPMENT AND MANAGEMENT
(Open Elective-II)

COURSE OBJECTIVES:
- There is a need to integrate groundwater and surface water management to ensure better overall water management and allocation due to the fact that management and protection of groundwater has been seriously neglected, potentially endangering the resource. Hence Engineers require complete understanding of ground water development and its management. This course discusses the occurrence of ground water & its movement, steady & unsteady flow estimations through confined & unconfined aquifers, surface & subsurface investigation methods, artificial recharging methods, concepts of conjunction use & some case studies.

COURSE OUTCOMES:
- A general framework of aquifer characterization
- Overview of groundwater and estimations through confined & unconfined aquifers, surface & subsurface investigation methods, artificial recharging methods
- knowledge to effectively carry out the Groundwater Resources development and management
- Broaden skills in team work, communication and planning through small projects.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3								3	2	1
CO2	3	2			3								3	2	1
CO3	3	2			3								3	2	1
CO4	3	2			3								3	2	1
Avg.	3	2			3								3	2	1

UNIT-I
Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

UNIT-II
Ground Water Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system. Ground water
flow contours their applications.

UNIT-III
Analysis of Pumping Test Data-I: Steady flow groundwater flow towards a well in confined and unconfined aquifers-Dupit's and Theism's equations, Assumptions, Formation constants, yield of an open well interface and well tests. Analysis of Pumping Test Data-II: Unsteady flow towards a well-Non equilibrium equations-Thesis solution-Jacob and Chow's simplifications

UNIT-IV
Surface and Subsurface Investigation: Surface methods of exploration-Electrical resistivity and Seismic refraction methods. Subsurface methods-Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

UNIT-V

Artificial Recharge of Ground Water: Concept of artificial recharge-recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies. Saline Water Intrusion in aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion.

UNIT-VI

Groundwater Basin Management: Concepts of conjunction use, Case studies.

TEXT BOOKS:

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.
2. Groundwater by H.M. Raghunath, Wiley Eastern Ltd.

REFERENCES:

1. Groundwater by Bawvwr, John Wiley & sons.
2. Groundwater Syatem Planning & Managemnet-R.Willes & W.W.G.Yeh, Printice Hall.
3. Applied Hydrogeology by C.W.Fetta, CBS Publishers & Distributers.

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(A0153207) COST EFFECTIVE HOUSING TECHNIQUES
(Open Elective-II)

COURSE OBJECTIVES:
This Course will enable students:
- To possess comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects.
- To focuses on cost effective construction materials and methods.
- To understand on the principles of sustainable housing policies and programmes.
- To adopt the suitable techniques in rural and disaster-prone areas by using locally available materials.

COURSE OUTCOMES:
Student will be able to:
- Development of construction technology and innovative techniques as tools to address demand mass construction
- Knowledge of eco-friendly material with their application
- Learn the use of locally available material according to their availability and maintenance

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3								3	2	1
CO2	3	2			3								3	2	1
CO3	3	2			3								3	2	1
CO4	3	2			3								3	2	1
Avg.	3	2			3								3	2	1

UNIT-I
A) Housing Scenario
Introduction - Status of Urban Housing - Status of Rural Housing
B) Housing Finance:
Introducing - Existing Finance System in India - Government Role as Facilitator - Status at Rural Housing Finance - Impedimental in Housing Finance and Related Issues
C) Land Use and Physical Planning for Housing
Introduction - Planning of Urban Land - Urban Land Ceiling and Regulation Act - Efficiency of Building Bye Lass - Residential Densities
D) Housing The Urban Poor
Introduction - Living Conditions in Slums - Approaches and Strategies for Housing Urban Poor

UNIT-II DEVELOPMENT AND ADOPTION OF LOW-COST HOUSING TECHNOLOGY
Introduction - Adoption Of Innovative Cost Effective Construction Techniques - Adoption Of Precast Elements In Partial Predatoriness - Adopting Of Total Prefixation Of Mass Housing In India- General Remarks On Pre Cast Rooting/Flooring Systems -Economical Wall System - Single Brick Thick Loading Bearing Wall - 19cm Thick Load Bearing Masonry Walls - Half Brick Thick Load Bearing Wall - Fly ash Gypsum Thick For Masonry - Stone Block Masonry - Adoption Of Precast R.C. Plank And Join System For Roof/Floor In The Building

UNIT-III ALTERNATIVE BUILDING MATERIALS FOR LOW-COST HOUSING
Introduction - Substitute for Scarce Materials-Ferrocement - Gypsum Boards – Timber Substitutions - Industrial Wastes - Agricultural Wastes - Fitire Starateru; For, P,Topm of

Alternative Building Maintenance

UNIT-IV LOW-COST INFRASTRUCTURE SERVICES

Introduce - Present Status - Technological Options - Low-Cost Sanitation - Domestic Wall - Water Supply, Energy.

UNIT-V RURAL HOUSING

Introduction Traditional Practice of Rural Housing Continuous - Mud Housing Technology. Mud Roofs - Characteristics of Mud - Fire Treatment For Thatch Roof - Soil Stabilization - Rural Housing Programs

UNIT-VI HOUSING IN DISASTER PRONE AREAS

Introduction-Earthquake - Damages to Houses - Traditional Prone Areas - Type of Damages and Railways Of Non-Engineered Buildings - Repair And Restore Action Of Earthquake Damaged Non-Engineered Buildings Recommendations For Future Constructions. Requirements Of Structural Safety of Thin Precast Roofing Units Against Earthquake Forces Status Of R& D In Earthquake Strengthening Measures - Floods, Cyclone, Future Safety

TEXT BOOKS

1) Building Materials for Low –Income Houses-International Council for Building Research Studies and Documentation.
2) Hand Book of Low Cost Housing by A.K.Lal-Newage International Publishers.
3) Properties of Concrete-Neville A.M. Pitman Publishing Limited, London.

REFERENCES

1) Light Weight Concrete, Academic Kiado, Rudhai.G-Publishing Home of Hungarian Academy of Sciences 1963.
2) Low-Cost Housing-G.C. Mathur.
3) Modern Trends In Housing In Developing Countries-A.G. Madhava Rao, D.S. Ramachandra Murthy & G.Annamalai.

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(A0125206) ADVANCED GEOTECHNICAL ENGINEERING
(Professional Elective-II)

COURSE OBJECTIVES:
- Provide knowledge in soil exploration methods.
- Provide knowledge about various types of foundations and various bearing capacity equations.
- Provide knowledge about deep & well foundations.
- Learn various slope stability methods

COURSE OUTCOMES:
At the end of the course, student is able to:
- Able to design & execute the soil exploration scheme.
- Able to find allowable bearing pressure based on different field tests and to find the settlement ofshallow foundations.
- Able to Analyze, design and construct the deep foundation based on soil investigation
- Able to perform the stability analysis of given slope and design retaining structure (gravity& sheet pilewall)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	1	-	1	1	1	1	1	1	1	3	2	1
CO2	1	3	2	1	-	1	1	1	1	1	1	1	3	2	1
CO3	1	3	2	1	1	1	1	1	1	1	1	1	3	2	1
CO4	1	3	2	1	1	1	1	1	1	1	1	1	3	2	1
Avg.	1	3	2	1	1	1	1	1	1	1	1	1	3	2	1

UNIT-I SOIL EXPLORATION
Need-Methods of soil exploration-Boring and Sampling methods-Field tests-Penetration Tests-Plate load test-Pressure meter-planning of Program and preparation of soil investigation report.

UNIT-II SHALLOW FOUNDATIONS
Safe bearing pressure based on N - value, CPT-allowable bearing pressure; safe bearing capacity and settlement from plate load test-allowable settlements of structures-Settlement Analysis-Design of Foundations for equal settlement.

UNIT-III EARTH SLOPE STABILITY
Infinite and finite earth slopes-types of failures-factor of safety of infinite slopes-stability analysis by Swedish arc method, standard method of slices, Bishop's Simplified method-Taylor's Stability Number- Stability of slopes of earth dams under different conditions.

UNIT-IV EARTH PRESSURE THEORIES
Rankine's theory of earth pressure-earth pressures in layered soils-Coulomb's earth pressure theory-Rebhann's and Culmann's graphical method

UNIT-V RETAINING WALLS
Types of retaining walls-stability of gravity retaining walls.-Sheet Pile wall analysis and design- Anchored Sheet Piles Analysis- Mechanical stabilized Retaining structure

UNIT-VI DEEP FOUNDATIONS
PILE FOUNDATION
Load carrying capacity of piles based on static pile formulae-Pile load tests-Load carrying capacity of pile groups –Load carrying capacity of under reamed piles based on IS Code–Settlement of pile groups.

WELL FOUNDATIONS

Types-Different shapes of wells-Components of wells-functions and Design Criteria-Sinking of wells-Tilts and shifts.

Note: Relevant IS: codes and tables are permitted for examination

TEXT BOOKS:

1) Soil Mechanics and Foundation Eng., K.R. Arora, 12th edition, Standard Publishers and Distributors, Delhi, 2021.
2) Foundation Engineering, Varghese, P.C. 10th edition, Prentice Hall of India., New Delhi, 2020.

REFERENCES:

1) Principles of Foundation Engineering, Bajra M. Das, Cengage India Pvt Ltd, 2020.
2) Foundation Analysis and Design, Joseph E Bowles, (2017), McGraw - Hill Publishing company, Newyork, 2020.
3) Analysis and Design of Substructures, Swami Saran, Oxford and IBH Publishing company Pvt Ltd, 2020.
4) Geotechnical Engineering, Gulati S. K & Manoj Dutta, Tata Mc. Grawhill Publishers New Delhi, 2020.
5) Geotechnical Engineering, C. Venkataramiah, 15th edition, new age International Pvt. Ltd, 2021.
6) Geotechnical Engineering, V.N.S. Murthy, CRC Press, New york, 2020.
7) Soil Mechanics and Foundation, B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi, 2020.

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(A0126206) PRESTRESSED CONCRETE
(Professional Elective-II)

Pre-requisites: Design of concrete structures.

COURSE OBJECTIVES:

- The main objective of the course is to design the pre-tensioned and post-tensioned members.

COURSE OUTCOMES:

At the end of the course student is able to:

- Get the knowledge on basic concepts of prestressed concrete
- Evaluate the losses that occur in pre-tensioning and post-tensioning members
- Difference between methods of pre-stressing systems
- Determine limit state of serviceability of members
- Understand the short-term deflections
- Design the pre-stressed concrete members for flexure and shear

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2		-	-	-	-	-	-		1	3	
CO2		1	1	1		-	-	-	-	-	-	2	1	3	
CO3	3	3	3	3	2	-	-	-	-	-	-	2	1	3	
CO4		1	1	2		-	-	3	-	-	-	2	1	3	1
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	3	1
CO6								3				2	1		1

UNIT-I INTRODUCTION

Basic concepts of prestress concrete - Historic development - Advantages and limitations of prestressed concrete-Materials-High strength concrete and high tensile steel their characteristics.

UNIT-II METHODS OF PRESTRESSING

I.S Code provisions, Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods-Analysis of post tensioning - Different systems of prestressing like Hoyer System, Magnel System Freyssinet system and Gifford-Udall System.

UNIT-III LOSSES OF PRESTRESS

Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortage ofconcrete, shrinkage of concrete, creep of concrete, Relaxation of steel, bending of member and frictional losses.

UNIT-IV LIMIT STATE DESIGN CRITERIA FOR PRESTRESSED CONCRETE MEMEBERS

Introduction-Inadequacies of the Elastic and Ultimate Load Methods-Philosophy of Limit-State Design-Criteria for Limit States-Design Loads and Strengths-Strength and Serviceability limit States- Crack Width in Prestressed Members-principles of Dimensioning Prestressed Concrete Members.

UNIT-V ANALYSIS AND DESIGN OF SECTIONS:

Analysis of sections for flexure; Elastic analysis of concrete beams prestressed with straight, concentric,eccentric, bent and parabolic tendons. Allowable stress, Design criteria as per I.S Code-Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses-design for shear in beams-Kern-lines, cable profile.

UNIT-VI DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS

Importance of control of deflections-factors influencing deflections-short term deflections of uncracked member's prediction of long-term deflections.

TEXT BOOKS

1 Prestressed Concrete, Krishna Raju, 10th edition, Tata McGraw Hill Publications, 2020.
2 Prestressed Concrete, N. Rajasekharan, 10th edition, Narosa publications, 2020.

REFERENCE:

1. Prestressed Concrete, Ramamrutham, 10th edition, Dhanpatrai Publications, 2020.
2. Design of Prestressed concrete structures, 10thn edition, T.Y. Lin, and Ned H. Burns, John Wiley andSons, 2020.

CODES

- BIS code on prestressed concrete, IS: 1343-2012. These codes are permitted in the examinations

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(A0127206) HYDRAULIC STRUCTURES
(Professional Elective-II)

COURSE OBJECTIVES:
- Practicing design principles of various hydraulic structures is very much essential for a Civil Engineer. This course discusses overview of dams and reservoirs such as types of dams, design and construction methodology of gravity and earthen dams, overview of spillways. Seepage is inevitable when the structure constructed across the water flow. Hence the pressure due to seepage estimated by Bligh's creep theory and Khosla's theories are discussed. In addition to this the design principles of cross drainage works; canal falls are practiced.

COURSE OUTCOMES:
At the end of the course student is able to:
- Get the knowledge of hydraulic structures and fixing the storage capacity of reservoirs
- Understand the design principles of Gravity and Earthen dams
- Get the knowledge of Spillways, Gates and design of Ogee Spillway
- Do seepage analysis though the soil under impervious floors of Hydraulic Structures
- Do analysis and design of Canal falls and Cross Drainage works.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		-	-	2	-	-	-	-	-	-	1	2	-
CO2	3	3	3	-	-	2	-	-	-	-	-	-	1	2	-
CO3	3	2	3	-	-	2	-	-	-	-	-	-	1	2	-
CO4	3	3	3	-	-	2	-	-	-	-	-	-	1	2	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-	1	2	-
Avg.	3	3	3	-	-	2	-	-	-	-	-	-	1	2	-

UNIT-I INTRODUCATION TO DAMS & RESERVOIRS
Types of dams, merits and demerits, factors affecting selection of type of dam, factors governing selecting site for dam, types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve.

UNIT-II GRAVITY& EARTHEN DAMS:
Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a low gravity dam, stability analysis, drainage galleries. Types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage.

UNIT-III SPILLWAYS
Types of spillways, design principles of Ogee spillways, types of spillway gates.

UNIT-IV DIVERSION HEAD WORKS
Types of Diversion head works-diversion and storage head works, weirs and barrages, layout of diversion head works, components. Bligh's creep theory, Khosla's theory, determination of uplift pressure, impervious floors using Bligh's and Khosla's theory, exit gradient

UNIT-V CANAL STRUCTURES
Types of falls and their location, design principles of Sarda type fall, trapezoidal notch fall and straight glacis fall, principles of design of distributary and head regulators

UNIT-VI CROSS DRAINAGE WORKS
Types of cross drainage works, selection of site, design principles of aqueduct, siphon aqueduct and super passage.

TEXT BOOKS

1. Irrigation engineering and hydraulic structures by S.K Garg, Khanna publishers.2021.
2. Irrigation and Water Power Engineering Punmia and Lal, Laxmi Publications, New Delhi, 2020.

REFERENCES

1. Irrigation Water Power and Water Resources Engineering, K.R.Arora, 10th edition, 2020.
2. Irrigation Engineering R.K. Sharma and T.K. Sharma, S. Chand Publishers, 2021.
3. Irrigation and water resources engineering G.L. Asawa, New Age International Publishers.2021.
4. Theory and Design of Hydraulic structures Varshney, Gupta & Gupta, 2020.
5. Water Resources engineering Satyanarayana Murthy. Challa, New Age International Publishers, 2019.

NOTE

- Khosla's Charts, necessary tables and graphs are permitted in the Examination Hall.

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(A0128206) BRIDGE ENGINEERING
(Professional Elective-II)

Pre-requisites: Design of concrete structures.

COURSE OBJECTIVES:

- To develop an understanding of and appreciation for basic concepts in proportioning and design ofbridges in terms of aesthetics, geographical location and functionality.
- To help the student develop an intuitive feeling about the sizing of bridge elements, ie. develop a clearunderstanding of conceptual design.
- To understand the load flow mechanism and identify loads on bridges.
- To carry out a design of bridge (like box culvert, T-beam bridge etc.,) starting from conceptual design,selecting suitable bridge, geometry to sizing of its elements

COURSE OUTCOMES:

At the end of the course student is able to:

- Have knowledge of types and components of bridges
- Understand IRC loading that act on RCC bridge and its effects
- Design RCC deck slab and T-Beam bridge girders
- Design sub-structure like piers and abutments
- Design various types of bearings

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												3	
CO2	3	2			2	2								3	
CO3	3	2	2	2	2	2		2			1	2		3	2
CO4		3	3			2		2			1	2		3	2
CO5		3	3			2		2			1	2		3	2

UNIT-I INTRODUCTION

Definitions, components of a bridge, classification, importance and standard specifications.

UNIT-II IRC LOADING STANDARD

Indian Road Congress (IRC) bridge code, width of carriageway, clearances, loads to be considered - dead load, IRC standard live loads, impact effect, wind loads, longitudinal forces, centrifugal forces, horizontal forces due to water currents, buoyancy effect, earth pressure, temperature effect, deformation stresses, secondary stresses, erection stresses, seismic effects.

UNIT-III DESIGN OF DECK SLAB

General Features - Courbon's method for computation of Deck Slab-Design Examples.

UNIT-IV DESIGN OF TEE BEAM

General features - Design example of T-beam

UNIT-V DESIGN OF PIERS AND ABUTMENTS

General Features-Bed Block-Materials for Piers and Abutment-Forces acting on Piers-Design of Piers-Stability Analysis of piers-Forces acting on Abutment-Stability Analysis of Abutment - Design of Abutment

UNIT-VI DESIGN OF BEARINGS

General Features-types of Bearings-Design of Rocker and Roller Bearings-Design of Elastomeric pad Bearing.

Note: Necessary tables and codes are permitted in the Examination Hall.

TEXT BOOKS:

1. Design of Bridges, N. Krishna Raju, 10th edition, Oxford & IBH Publishing Co. Pvt Ltd, 2020.
2. Essentials of bridge engineering, Johnson Victor D, Oxford & IBH Publishing Co. Pvt Ltd, 2019.

REFERENCE BOOKS:

1. Standard specifications and code of practice for road bridges IRC: 06 - 2017, Bureau of IndianStandards, India
2. Standard Specifications and Code of Practice for Road Bridges Section: III Cement Concrete (Plainand Reinforced) IRC: 21 - 2000, Bureau of Indian Standards, India
3. Standard Specifications and Code of Practice for Road Bridges Section: IX Bearings IRC: 83 - 2015,Bureau of Indian Standards, India

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(A0529206) BASICS OF JAVA PROGRAMMING
(Skill Development Course)

COURSE OBJECTIVES:
- Java was designed with the principle of "write once, run anywhere" (WORA).
- Java is built around the concept of objects and classes, promoting modular and reusable code

COURSE OUTCOMES:
- Students should be able to understand and use fundamental Java syntax, data types, variables, and operators
- Students should be able to implement decision-making (if-else, switch) and looping (for, while) structures in Java programs
- Students should understand and apply concepts like classes, objects, inheritance, and polymorphism to design and implement simple object-oriented programs.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2											
CO2	2	2	2	2											
CO3	2	2	2	2											

UNIT-I

INTRODUCTION TO JAVA: Introduction to OOP, OOP Concepts, The History and Evolution of Java, Differences from C, C++ and JAVA, The Java Buzzwords, Simple Program, Compiling the Program, Structure of Java Program, data types, variables, constants, type conversion and casting, enumerated types, scope and life time of variables, operators, expressions, control statements, arrays.

INTRODUCTIONS TO CLASS AND OBJECTS: Overview of classes, creations of objects, instant variables and methods, constructors, access controls, usage of this, Garbage Collection and finalize.

UNIT-II

MORE ON CLASSES AND METHODS: Objects as arguments, returning objects, Recursion, overloading methods and constructors, understanding static, Introducing Nested and Inner Classes, Using Command-Line Arguments.

INHERITANCE: Overview, Super and Sub classes, Member access rules, types of Inheritance, super uses, method overriding, Dynamic method dispatch, abstract classes and methods, use of final, the Object class and its methods.

UNIT-III

PACKAGES: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, access protection.

INTERFACES: Interfaces vs. Abstract classes, defining interfaces, implementing interfaces, Nested Interfaces, Interfaces Can Be Extended, Default Interface Methods, and Use static Methods in an Interface.

UNIT-IV

STRING HANDLING: Strings, String Constructors, string functions: Special String Operations, string functions, String Comparison, Searching Strings, modifying a String, Data Conversion Using Value Of, Joining Strings, String Buffer, String Builder.

Primitive Type Wrappers, **some java. util package classes:** String Tokenizer, Date, Calendar, Random, and Scanner.

UNIT-V

INPUT /OUTPUT EXPLORING OF JAVA.IO: I/O Basics, Streams, Byte Streams and Character Streams, The Predefined Streams, Reading Console Input, Writing Console Output, Print Writer Class, Reading and Writing Files, File class, The Auto Closeable,Closeable, and Flushable Interfaces, File zipping and unzipping, Serialization, Static Import.

UNIT-VI EXCEPTION HANDLING: Fundamentals, exception types, usage of try, catch, multiple catch Clauses, Nested try Statements, Usage of throw, throws and finally, built in exceptions, creating your own exceptions subclasses.

MULTITHREADING: Overview, difference between process and thread, Main thread, creating threads, thread life cycle, creating multiple threads, use of is Alive () & join (), thread priorities, thread synchronization, interthread communication, deadlock.

TEXT BOOKS

1. Java, the complete reference, 9th Editon, Herbert schildt, Oracle Press, MGHE, 2020.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson education, 2020.

REFERENCES

1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley &sons, 2020.
2. Programming in Java, Sachin Malhotra, Saurabh Choudhary, Second Edition, 2019.
3. An Introduction to OOP, T. Budd, second edition, Pearson education, 2020.
4. Introduction to Java programming, Y. Daniel Liang 6th edition, Pearson education, 2020.
5. An introduction to Java programming and object-oriented application development, R.A. Johnson-Thomson, 2020.
6. Core Java 2, Vol 1, Fundamentals, Cay. S. Horstmann and Gary Cornell, seventh Edition, PearsonEducation, 2020.
7. Core Java 2, Vol 2, Advanced Features, Cay. S. Horstmann and Gary Cornell, Seventh Edition,Pearson Education, 2020.

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(A0014203) INDIAN HERITAGE & CULTURE
(Mandatory Learning Course)
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

INTRODUCTION
- Indian Heritage is an ancient facet pertaining to bygone ages. It reflects strong ethical culture and embodimentof nature in life style. It had its deep roots in great Indian epics and Upanishads. It has been transformed and strengthened by many kings and queens. It is revived by erudite writers. The glory of Indian Heritage & culture have been ignored or distorted in wake of western culture. The present generation ought to know their indigenous culture and heritage and apply the wisdom to the current core working aspects.

COURSE OBJECTIVES:
- To enable the students to have an insight into and understanding of the great heritage and culture ofIndia.
- To sensitize them towards preservation and progression of the composite culture of India
- To make students learn soft skills and life skills from ancient treatise
- Relevance of architecture & ancient principle to the current engineering scenario

COURSE OUTCOMES:
- Equip learners with knowledge of the heritage and culture of India.
- Acquire Leadership & Soft skills from great leaders of India
- Apply the ancient wisdom to become successful professionals
- To make them understand diversity of culture and national integrity

UNIT-I
Origin of Indian Culture & Heritage –Indus valley Civilization - Time line of Indian empires - Cultural & social conditions of India under Mauryas, Guptas & the Sathavahanas

UNIT-II
Influence of Islam on Indian Culture - Leadership skills from Akbar the Great & Krishnadeva Raya -World Heritage Sites in India

UNIT-III
Great Indian Epics-Life skills from Ramayana and Mahabharata-Ethics from Upanishads &-Vedas - Patanjali Yoga -Principles of Jainism, Buddhism & Sufism

UNIT-IV
Indian Art Forms –Literature - Rabindranath Tagore - RK.Narayan - Sri Sri - Jashuva-Music - Saint Tyagaraja, Annamayya -Purandhara Das - Kabir Das- Dance Forms of India

UNIT-V
Social awakening and social reform movements -Theosophical Society - Emancipation of Women inpre-independent era

UNIT-VI
Mahatma Gandhi - Non-violence and Satyagraha - Great leaders of Freedom struggle-Subhash Chandra Bose-Bhagath Singh –Moulana Abul Kalam Azad-B.R.Ambedkar - Post Independent Era.

TEXT BOOK

1) Madanlal Malpani & Shamsunder Malpani (2009), ***Indian Heritage and Culture,*** New Delhi: KalyaniPublishers.

REFERENCE BOOKS

1) Romila Thapar (2018), Indian Cultures as Heritage: Contemporary Pasts, India.
2) Anurag Mathur (2017), Indian Culture & Heritage, Create space independent publishing Platform, 2017.
3) P.R.Rao & P. Raghavendra , Indian Heritage and culture, Sterling Publication Pvt. Ltd.
4) Madhukar Kumar Bhagat, Indian Heritage and culture, Access Publications.
5) Dhirendra Singh, Indian Heritage and culture, APH Publications.

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(A0197206) GEOGRAPHICAL INFORMATION SYSTEMS LAB

COURSE OBJECTIVES:

- The main objective of GIS Lab is to apply the spatial analysis techniques and to use applications of GIS in CivilEngineering areas.

COURSE OUTCOMES:

At the end of the course student is able to:

- Understand the process of mapping and measurements using GIS.
- Create elevation models and analyze the data.
- Apply GIS analysis in the civil engineering areas.
- Learn the processes of data acquisition and utilize the data as input data.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	3	3	-	3	2	1	2	2	3	1	1	-
CO2	2	2	-	3	3	-	3	2	1	2	2	3	1	1	-
CO3	2	2	-	3	3	-	3	2	1	2	2	3	1	1	-
CO4	2	3	-	3	3	-	3	2	1	2	2	3	1	1	-
Avg.	2	3	-	3	3	-	3	2	1	2	2	3	1	1	-

SOFTWARES

1. ArcMap, ERDAS IMAGINE, Geo Media, IDRISI
2. Open source software like GRASS GIS, ILWIS, JUMP GIS, Map Window GIS, QGIS, SAGA GIS

EXCERCISES

1. Digitization of Map/Toposheet
2. Creation of Thematic Maps
3. Study of features estimation
4. Developing Digital Elevation Model (DEM) using topographic information
5. Creation of TIN file
6. Application of GIS in Water Resources Engineering
7. Application of GIS in Transportation Engineering
8. Extraction of features and making measurements using Google Earth
9. Feature extraction through Open Street Map
10. Landsat Data extraction

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(A0198206) ENVIRONMENTAL ENGINEERING LAB

COURSE OBJECTIVES:

- Civil Engineers must be in a position to predict the quality of water, wastewater and sludge/Solid.
- This course motivates the students to learn different experimental techniques to Analyze and characterize the water, wastewater and sludge quality from different sources in terms of its physical, chemical and biological parameters by using different chemical, instrumental and analytical techniques.
- They can use the knowledge of physics, chemistry, biology and mathematics to do this lab.

COURSE OUTCOMES:

At the end of the course student is able to:

- Estimate physical, chemical and biological characteristics of water and waste water
- Determine optimum dosage of coagulants.
- Asses the quality of water and waste water.
- Measure the quality parameters using environmental testing equipment

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	2	-	2	1	-	1	1	-	3
CO2	3	2	1	-	-	2	2	-	2	1	-	1	1	-	3
CO3	3	2	1	-	-	2	2	-	2	1	-	1	1	-	3
CO4	3	2	1	-	-	2	2	-	2	1	-	1	1	-	3

ANALYSIS OF WATER QUALITY PARAMETERS

1. Determination of pH
2. Taste and Odor
3. Determination of Acidity and Alkalinity
4. Determination of Chlorides
5. Determination of Dissolved Oxygen
6. Estimation of Sulphates
7. Estimation of Total Dissolved Solids.
8. Estimation of Conductivity
9. Determination of Turbidity
10. Estimation of Hardness of water by EDTA Titration Method
11. Determination of Available Chlorine in Bleaching Powder, Residual Chlorine, Break PointChlorination and Chlorine Demand.
12. Optimum Coagulant Dose by Jar Test Apparatus
13. Determination of MPN Index for Coliforms

ANALYSIS OF WASTEWATER QUALITY PARAMETERS

1. Determination of Total solids, settle able solids, dissolved solids and volatile Solids.
2. Determination of BOD and COD
3. Determination of Ammonia–nitrogen and Nitrates.
4. Estimation of Phosphates

TEXT BOOK

1. Chemistry for Environmental Engineering, Sawyer, N.C., and McCarty, P.L., McGraw-Hill Book Co.,New York, 2020.

REFERENCE BOOK

1. Standard Methods for the Examination of Water and Waste Water, APHA-AWWAWPCF, 25thEdition., Washington (D.C), 2021.

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(A0199206) TRANSPORTATION ENGINEERING LAB

Prerequisites: Transportation Engineering.

COURSE OBJECTIVES:

- The objective of the course is to conduct tests on Aggregates & Bituminous materials.

COURSE OUTCOMES:

At the end of the course student is able to:

- Perform quality control tests on pavements and pavement materials

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													3	3
CO2	3													3	3
CO3	3													3	3

Tests on Aggregate and Bitumen

1) Determination of strength of the aggregate by crushing test using compression testing machine.
2) Determination of toughness value of aggregate by impact test.
3) Determination of water absorption value of aggregate by using water absorption test
4) Determination of flakiness index and elongation index by shape test using thickness gauge and lengthgauge
5) Determination of hardness of aggregate by Los Angles Abrasion test.
6) Determination of grade of bitumen by penetration test using penetrometer.
7) Determination of ductile value of bitumen using ductility testing machine.
8) Determination of softening value of the bitumen using ring and ball test.
9) Determination of flash and fire value of the bitumen
10) Determination of Stability and flow value of bitumen mix using Marshall Stability Test.