SYLLABUS IV YEAR B.TECH. (CIVIL ENGINEERING)
AUTONOMOUS REGULATIONS 2019

(Effective for the batches admitted in 2019-20 onwards)

DEPARTMENT OF CIVIL ENGINEERING
ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (A)
(Affiliated to AU, Approved by AICTE & Accredited by NBA)
SANGIVALASA, Bheemunipatnam Mandal, Visakhapatnam District-531162

INSTITUTE VISION

- To emerge as a world class technical institution

INSTITUTE MISSION

To impart holistic technical education by providing

- The state of the art infrastructure
- Exceptional technical and teaching expertise
- Best of human value

VISION OF THE DEPARTMENT

- To emerge as a leading Civil Engineering Department globally

MISSION OF THE DEPARTMENT

- Empower our students with contemporary and industry relevant skills in Civil Engineering using outstanding technical and teaching expertise and best of infrastructure
- Nurture holistic development of our students inculcating universal human values and life skills for serving the society as leaders of their profession

Program Educational Objectives (PEOs)

PEO1: Successfully practice Civil Engineering in construction industry, public sector and entrepreneurship, ensuring a prosperous professional career.

PEO2: Pursue higher education and Research for professional development contributing to the advancement of civil engineering through lifelong learning

PEO3: Demonstrate leadership abilities actively contributing to societal needs with a focus on sustainable development and human values.

Program Outcomes

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

1. Plan and develop safe, economical and sustainable buildings and other structures based on applicable professional standards, codes and ethics.
2. Analyze and solve stability problems in soils for design of foundations and earth structures and plan and design highway, railway and other transportation systems based on applicable safety standards, codes and ethics.
3. Plan and develop irrigation and water supply systems and analyze and solve problems due to pollution of air, water and land leading to a nourished, richer and healthy society

IV Year Course structure

Semester - I

Course Code	Title of the course	Category	Periods						Sessionals Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				
CIV411	Open Elective-III#	OE	2	1	0	1	2	6	40	60	100	3
CIV412	Steel Structures	PC	2	1	0	2	3	8	40	60	100	3
CIV413	Project Planning & Management	PC	2	1	0	1	2	6	40	60	100	3
CIV414	Professional Elective – I	PE	3	0	0	1	2	6	40	60	100	3
CIV415	Professional Elective – II	PE	2	1	0	2	3	8	40	60	100	3
CIV416	Computer Applications in Civil Engineering Lab-II	PC	0	0	3	0	2	5	50	50	100	1.5
CIV417	Transportation Engineering Lab	PC	0	0	3	0	1	4	50	50	100	1.5
CIV418	Project work-I	PR	0	0	6	0	6	12	100	-	100	4
CIV419	Summer Internship*	PR	0	0	0	0	4	4	100	-	100	1
Total			**11**	**4**	**12**	**7**	**25**	**59**	**500**	**400**	**900**	**23**

Semester - II

Course Code	Title of the course	Category	Periods						Sessionals Marks	Semester end Exam marks	Total Marks	Credits
			L	T	P	E	O	Total				

CIV421	Open Elective - IV#	OE	2	1	0	1	2	6	40	60	100	3
CIV422	Professional Elective – III	PE	2	1	0	1	2	6	40	60	100	3
CIV423	Professional Elective – IV	PE	2	1	0	1	2	6	40	60	100	3
CIV424	Professional Elective – V	PE	2	1	0	1	2	6	40	60	100	3
CIV425	Project Work –II	PR	0	0	9	0	9	18	50	50	100	6
Total			**8**	**4**	**9**	**4**	**17**	**42**	**210**	**290**	**500**	**18**

*** Summer Intership** *to be conducted after III year-II semester and evaluated in IV year-I semester*

 # Open Electives can be either interdisciplinary subjects/emerging subject/MOOCs as decided by the Department.

IV Year I Sem

Detailed Syllabus

LIST OF PROFESSIONAL ELECTIVES (CIVIL ENGINEERING) (R 19)

IV B.Tech – I Semester

Professional Elective – I (CIV 414)

1.Water Recourses Engineering – II

2. Solid Waste Management

3. Repair and Rehabilitation of structures

4. Urban Planning and Smart Cities

Professional Elective – II (CIV 415)

1. Transportation engineering - II

2. Disaster Management

3. Advanced Geotechnical Engineering

4. Soil Dynamics and Machine Foundations

IV B.Tech – II Semester

Professional Elective – III (CIV 422)

1. Pre stressed concrete

2. Advanced Fluid Mechanics

3. Advanced Design of structures

4. Ground Improvement Techniques

Professional Elective – IV (CIV 423)

1. Water shed management

2. Advanced Building Construction

3. Earthquake Engineering

4. Environment Impact Analysis

5. Air Pollution Control

Professional Elective – V (CIV 424)

1. Optimization Techniques

2. RS & GIS applications in Civil Engineering

3. Bridge Engineering

4. Introduction to Finite Element Methods

5. Engineering Economics and Finance

STEEL STRUCTURES

CIV 412 **Credits : 3**

Instruction : 3 Lectures & 1 Tutorial / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Engineering Mechanics, Strength of materials, Structural Analysis

Course objectives:

The objective of this course is to

1. Familiarize students with different types of connections and relevant IS codes
2. Understand the design concepts of tension and compression members
3. Familiarize students with concepts of design of flexural members
4. Understand the design concepts of plate girder
5. Familiarize students with different types of column bases and their design

Course outcomes:

At the end of this course the student will be able to

1. Design structural steel bolted joints.
2. Design structural steel welded joints and members subjected to tension.
3. Design structural steel members subjected to compression.
4. Design a column base, structural steel members subjected to bending.
5. Design a welded plate girder.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	3										3		
	2	3	3	3										3		
	3	3	3	3										3		
	4	3	3	3										3		
	5	3	3	3										3		

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Note: All the designs should be in the limit state design method as per IS 800-2007

UNIT – I 12 Periods

Introduction: Fundamentals of Design philosophies, Concepts of limit state design of structures, Different types of rolled steel sections. Stress – Strain relationship for mild steel.

Bolted connections: Behaviour of bolted joints, Design strength of ordinary black bolts, high strength friction grip bolts, Simple connections (subjected to only axial load), Eccentric bolted connections (Type - I & Type - II)

UNIT – II 12 Periods

Welded Connections: Advantages of welded joints, Types and properties of welds, Types of joints, weld specifications, Simple connections (subjected to axial load), Eccentric welded connections (Type - I & Type - II)
Tension members: Design of angles and other sections for tension.

UNIT – III 12 Periods

Compression members: Design of axially loaded compression members, built up compression members, Laced and Battened columns. Column splices

UNIT – IV 12 Periods

Column bases: Allowable stress in bearing, Slab base, Gusset base
Beams: Beam types, section classifications, lateral stability of beams, Allowable stress in bending, shear and Bearing stresses, Effective length of compression flange, laterally supported and unsupported beams..

UNIT – V 12 Periods

Plate girders: Design considerations, IS Code of recommendations, Design of welded plate girder, Stiffeners and their connections

TEXT BOOKS

1. Duggal, S.K. (2014) "Limit State Design of steel structures", McGraw Hill Education Private Ltd.
2. Subramanian, N. (2011) "Design of Steel structures", Oxford University Press.

REFERENCES

1. Ramarmutham, S (2014), "Design of steel structures", Dhanpat Rai Publication company.
2. Sai Ram, K.S. (2015) "Design of steel structures", Pearson Education India.
3. Bhavikatti, S.S. (2014) "Design of steel structures by Limit State Method as per IS: 800-2007", IK International Publishing House.
4. IS 800 – 2007, "Indian Standard Code of Practise for General Construction in Steel" Bureau of Indian Standards.
5. Relevant NPTEL Courses.

PROJECT PLANNING & MANAGEMENT

CIV 413 **Credits: 3**
Instruction : 3 Lectures & 1 Tutorial / week Sessional Marks: 40
End Exam : 3 Hours End Exam Marks: 60

Course Objectives:
From this course students will learn the
1. Role and responsibilities of a project manager
2. Importance of project management in civil engineering projects
3. Management of resources in construction project
4. Understand labour problems and legislation in India

Course Outcomes:
At the end of the course, the students will be able to:
1. Develop a schedule of activities and estimate the project completion time using conventional techniques for a construction project.
2. Estimate the project completion time by applying various network techniques, namely Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT)
3. Analyse the project network for Optimization of cost, crash duration and assess for updating by considering project delays
4. Identify the prerequisite of the tendering process and classify different types of contracts.
5. Identify scientific management techniques and fundamentals of labour management.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3										2		2		
	2	2			2							2		2		
	3	3	3									2		2		
	4	3										2		2		
	5	3										2		2		

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UNIT – I 12 Periods

Planning and Scheduling: Introduction, Project management, Steps involved in planning; Objectives; Principles; Advantages; Limitations; Stages of planning; Scheduling, Preparation of construction schedules; Methods of scheduling; Bar charts; Mile stone charts; Controlling; Job layout; Factors affecting job layout; Project work break down; Activities involved; Assessing activity duration.

Project Management Through Networks: Objectives of network techniques; Fundamentals of network analysis; Events; Activities; Dummies; Types of networks; Choice of network type; Advantages of network techniques over conventional techniques.

UNIT – II 12 Periods

Program Evaluation and Review Technique (PERT): Introduction; Time estimates; Earliest expected time; Latest allowable occurrence time; Slack; Critical path; Probability of completion time for a project.

Critical Path Method (CPM): Introduction; Difference between CPM and PERT; Earliest event time; Latest event time; Activity time; Float; Critical activities and critical path.

UNIT – III 12 Periods

Cost analysis: Direct and indirect costs, operation time, Normal and crash points, optimising project cost, crash limit, Free float limit, Optimisation.
Updating – Process of updating; when to update

Resource scheduling – Resource smoothening, Resource levelling, circle notation and arrow notation.

UNIT – IV 12 Periods

Contracts: Definition, Conditions of contract, Contract document, Piece work Agreement form, work order; Types of contracts – Lumpsum contract; Lumpsum and schedule contract, Item rate contract, sub-contracts, joint ventures. Contract system with tenders – Definitions – Contractor, Quotation, Earnest money, Security money, Tender, Tender notice, Tender form.

UNIT – V 12 Periods

Management – Scope of the Construction Management, Significance of Construction management, Concept of Scientific Management, Qualities of Manager.
Organisation – Authority, Policy, Recruitment process and Training Development of Personnel Department, Labour problems, Labour legislation in India.

TEXT BOOKS

1. Punmia. B.C. and Khandelwal, K.K. (2017) "Project Planning and Control with PERT and CPM ", Laxmi Publications Ltd., New Delhi, 4th Edition.
2. Sengupta. B, Guha. H (2004), "Construction Management and Planning"; Tata Mc Graw Hill Publishing Company Ltd., New Delhi. 4th Edition

REFERENCE BOOKS

1. Srinath, L.S,(2001) "PERT & CPM Principles and Applications";Affiliated East West Press, 3rd Edition.
2. Dutta, B.N.(2016), "Estimating and Costing in Civil Engineering", Charator Publishing House 28th Edition.
3. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE – I

WATER RESOURCES ENGINEERING - II

CIV 414 A **Credits: 3**

Instruction: 3 Lectures & 1 Tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Fluid Mechanics – II; Water Resources Engineering - I

Course Objective:

To provide the necessary background for understanding the storage of water, various Head, Regulation and Cross drainage works and Hydel Power production.

Course Outcomes:

By the end of the course, the student will be able to

1. Analyze the Stress and stability of Gravity dams, by understanding the basic concepts of dams & design them
2. Analysis of seepage in earthen dams and design of suitable spillway
3. Examine the necessity of diversion head works and design weirs on permeable foundations
4. Examine the necessity of regulatory works on canals and design different types of falls
5. Identify the availability of Hydro power and its utilization & choose the suitable river training works depending on river conditions.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	3			3									3
	2	3	3	3			3									3
	3	3	3	3			3									3
	4	2	3	3			3									3
	5	3	2				2									3

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UNIT– I 12 Periods

Storage Works: Classification of dams, factors governing selection of type of dam, selection of site, preliminary investigations.

Gravity Dams: Types, Forces acting on a gravity dam, stability criteria, modes of failure, elementary and practical profiles, stability analysis, stress analysis, Construction joints, openings in dams - galleries, foundation treatment of gravity dam.

UNIT– II 12 Periods

Earth Dams: Types, foundation for earth dams, causes for failure of earth dams, criteria for safe design, phreatic line, seepage analysis – seepage control through body and foundation.

Spillways: Essential requirements, spillway capacity, components, types of spillways and their working, design of ogee spillway, spillway crest gates, energy dissipation below spill way, scour protection, use of hydraulic jump as energy dissipater.

UNIT – III 12 Periods

Diversion Head Works: Location and components, effects of construction of weirs on permeable foundation, Bligh's, Lane's and Khosla's theories, weirs and barrages, weirs on permeable foundations, design of weir, silt control devices.

UNIT – IV 12 Periods

Regulation Works: Canal falls, definition, necessity and location, classification of falls, design principles of notch fall (Sarda Type & Trapezoidal Type only), canal head regulator, cross regulator and off-take alignment.
Cross Drainage Works: Types, factors affecting the suitability of each type, classification, design principles of Aqueduct (Type-III).

UNIT – V 12 Periods

Water Power Engineering: Development of hydro power in India, assessment of available power, utilization factor, load factor, diversity factor, storage and pondage, types of hydro power schemes, components of hydel schemes – forebay, intake structure, trash racks, water hammer, surge tanks, substructure and super structure of power house.
River Engineering: Classification of Rivers, River Training and its objectives, Classification of River Training Works, Methods for River Training, Marginal Embankments or Levees, Guide Banks or Guide Bunds, Groynes or Spurs, Cut-offs, Bank Pitching and Launching Aprons, Pitched Islands, Miscellaneous Methods.

TEXT BOOKS

1. Punmia, B.C. and Lal Pande B.B. (2021), "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 12th edition.
2. Garg, S.K. (2018), Irrigation Engineering and Hydrology Structures, Khanna Publishers, Delhi, 16 thEdition.

REFERENCES

1. Modi, P.N. (2004), "Irrigation, Water Resources and Water Power Engineering", Standard Book House, Delhi, 6th Edition.
2. Relevant NPTEL Courses.

SOLID WASTE MANAGEMENT

CIV 414 B **Credits: 3**

Instruction: 2 Lectures & 1 Tutorials / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Environmental Science.

Course objectives:

The course content enables students to:

1. Develop insight into the collection, transfer, and transport of municipal solid waste.
2. Explain the design and operation of a municipal solid waste landfill.
3. Examine the design and operation of a resource recovery facility.

Course outcomes:

At the end of the course students are able to:

1. Analyse the characteristics of solid waste and discuss problems due to improper disposal of solid waste
2. Analyse the characteristics of solid waste and discuss problems due to improper disposal of solid waste
3. Analyse the various methods of collection, transfer and transport of wastes.
4. Classify various methods of processing and transformation of solid wastes
5. Analyse the various methods for proper disposal of sewage and design its components.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	3													2
	2	2	3													2
	3	2	3													2
	4	2	3													2
	5	2	3	1												2

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UNIT – I 12 Periods

Introduction: Definition of solid waste, garbage, rubbish, Sources and Types of solid wastes. Characteristics of Solid Wastes - Physical, chemical and biological characteristics- Problems due to improper disposal of solid waste.

UNIT – II 12 Periods

Basic Principles: Definition of Solid Waste Management - Reduction, reuse, recycling and recovery principles of waste management - Waste generation and handling at source- Functional elements of solid waste management

UNIT – III 12 Periods

Collection, Transfer and Transport of Wastes: Collection of solid wastes- Collection methods and service. Transfer station-Processing and segregation of the solid waste- various methods of material segregation.

UNIT – IV 12 Periods

Processing and Transformation of Solid Wastes: Composting: definition-methods of composting-advantages of composting- Incineration: definition- methods of incineration advantages and disadvantages of incineration.

UNIT – V 12 Periods

Disposal of Solid Waste: Volume reduction, Open dumping, land filling techniques. Landfills: classification-Design and Operation of landfills, Land Farming, Deep well injection.

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel Vigil (1993), "Integrated Solid Waste Management", McGraw Hill Publishers, USA, 2nd Edition.
2. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. (2013), "Environmental Engineering", McGraw-Hill, New York, 7th Edition.

REFERENCES

1. Oweis, I.S. and Khera, R.P. (1998), "Geotechnology of Waste Management", PWS Publishing Co., New York, 2nd Edition.
2. Bagchi, A. (2004), "Design of Landfills and Integrated Solid Waste Management", John Wiley & Sons, New Jersey, 3rd Edition.
3. Sharma, H. D. and Reddy, K. R. (2004) "Geoenvironmental Engineering", John Wiley & Sons, New Jersey, 1st Edition.
4. Relevant NPTEL Courses.

REPAIR AND REHABILITATION OF STRUCTURES

CIV 414 C **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Engineering Chemistry; Concrete Technology; Reinforced Concrete Structures I & II.

Course Objectives:

1. To learn about the non-destructive testing
2. To know the corrosion control techniques in steel
3. To know about crack control techniques in concrete
4. To adopt different strengthening techniques in concrete structures.

Course outcomes:

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

1. Explain various non-destructive tests to determine structural health
2. Describe miscellaneous non-destructive tests
3. Outline the mechanism of corrosion and its control in steel
4. Identify defects in concrete.
5. Analyse techniques to strengthen reinforced concrete structures.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2											2		
	2	2	2											2		
	3	2	2											2		
	4	2	2											2		
	5	2	2											2		

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UNIT – I 12 Periods

Non-destructive strength test

Techniques to test the existing strength- - Destructive tests- core sampling and testing -Non Destructive tests – rebound hammer test, ultrasonic pulse velocity test, pull out test, penetration techniques, acoustic emission techniques.

UNIT – II 12 Periods

Other non – destructive tests

Chemical test – carbonation and chloride content – Corrosion potential assessment – cover meter survey, half cell potential survey, resistivity measurement

Fire damage assessment – differential thermal analysis – X ray diffraction

Structural integrity/ soundness assessment – radiography, impact echo test, dynamic testing of structures –interpretation and evaluation of test result data

UNIT – III 12 Periods

Corrosion

Corrosion of reinforcement- Factors affecting corrosion of reinforcement embedded in concrete-Mechanism of electrochemical corrosion-Chloride attack-Carbonation-Corrosion Control.

UNIT – IV 12 Periods

Failures in concrete

Cracks in concrete-types and causes of concrete cracks-Repair of cracks-Common type of repairs-Sealing, Stitching, providing additional steel, Drilling & Plugging-Polymer based repairs-Resin based repairs.

UNIT – V 12 Periods

Strengthening of Reinforced Concrete structures

Retrofitting-Strengthening of Beams and Columns – Demonstration of Foundations and Slabs- Methodology – Strengthening of RC Structures

TEXT BOOKS

1. "Handbook on Repair And Rehabilitation of RCC Buildings", CPWD Published (2002).

REFERENCES

1. Bungey, J. H., Millard, S.G. and Grantham, M.G. (2006), "Testing of Concrete in Structures", Taylor and Francis, London, 4th Edition.
2. Shetty, M. S., (2006), "Concrete technology" S. Chand Publications, New Delhi, 7th Edition,
3. Ghambir, M.L., (2013), "Concrete technology", McGraw-Hill Education, New Delhi, 5th Edition.
4. Neville, A.M. (2011), "Properties of Concrete", Prentice Hall, New Delhi, 5th Edition.
5. Relevant I.S. Codes.
6. Relevant NPTEL Courses.

URBAN PLANNING AND SMART CITIES

CIV 414 D **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Building Planning & Drawing

Course Objectives:

To provide exposure to the student in urban planning and smart cities, the latter being the recent development.

Course outcomes:

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

1. Identify the Goals, Objectives, Components and Benefits of Planning the concept of smart city.
2. Explain the Urbanization Policies in India and the World
3. Discuss the importance of Sustainable Urban Development and its Parameters.
4. Outline Goals and Objectives of Sustainability and their practices.
5. Summarize the report of core indicator requirements with reference to ISO 37120.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3					1	1					2		2	
	2	3					2	1					2		2	
	3	3					1	2					2		2	
	4	3					1	2					2		2	
	5	3					1	2					2		2	

UNIT – I 9 Periods

Introduction: Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning;

Definition of Smart City; Evolution of Smart City concept; Smart City components and characteristics

UNIT – II 9 Periods

Urbanization Policies in India: Over view of world urbanization, National Urbanization policy, basic issues in urbanization policy; role of national and state level policies; five-year plans, latest attempts at urbanization policy formulation in the country; salient features of the report of the National Commission of Urbanization; Census definition of urban places; functional classification of urban places; India’s Smart City Mission

UNIT – III 9 Periods

Sustainable Urban Development: Changing perspectives in man-environment relationship with focus on issues of population, urbanization, resource depletion and pollution; limits to growth vis-a-vis sustainable economy; growth and environmental imperatives of developing vs developed countries; definitions, concepts and parameters in sustainable development with particular reference to Brundtland Commission, Agenda 21, Eco-city approach.

UNIT – IV 9 Periods

STAR Framework of Sustainability: Introduction, Goals & Objectives; Built Environment: Ambient Noise & Light; Community Water Systems; Compact & Complete Communities; Housing Affordability; Infill & Redevelopment; Public Parkland; Transportation Choices;

Climate & Energy: Climate Adaptation; Greenhouse Gas Mitigation; Greening the Energy Supply; Energy Efficiency; Water Efficiency; Local Gov GHG & Resource Efficiency; Waste Minimization;

Natural Systems; Green Infrastructure; Biodiversity & Invasive Species; Natural Resource Protection; Outdoor Air Quality; Water in the Environment; Working Lands;

Innovation & Process; Best Practices & Processes; Exemplary Performance; Local Innovation; Good Governance

UNIT – V 9 Periods

ISO 37120 City indicators: Core Indicator requirements; Supporting Indicator requirements; Data Sources; Environment; Solid waste; Transportation; Urban planning; Wastewater; Water and Sanitation; Reporting and record maintenance

TEXT BOOKS

1. Peter Hall, (2010), "Urban and Regional Planning", Routledge Publishing, 4th Edition.
2. Kulshrestha, S. K., (2012), "Urban and Regional Planning in India - A Handbook for Professional Practice," Sage Publications, New Delhi.

REFERENCES

1. STAR Community Rating System, Version 2.0, October 2016, STAR Communities Washington, DC
2. Sustainable development and resilience of communities-Indicators for city services and quality of life, ISO/DIS 37120, 2018, Switzerland.
3. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - II

TRANSPORTATION ENGINEERING - II

CIV 415 A **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Nil

Course Objective:

1. To study various components and their functions in a railway track.
2. To acquire design principles of geometrics in a railway track.
3. To study various elements in points and crossings.
4. To acquire design principles of airport geometrics and pavements.

Course Outcomes:

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

1. Analyse the factors affecting for the selection of gauge system in railways
2. Design geometrics of railway track and analyse the criteria for fixing the alignment
3. Apply the railway engineerng principles to classify the points and crossings, track junctons and station yards
4. Design geometrics of runway based on te topgraphical and climate conditions
5. Analyse the various components of port by applying its natural phenomenon.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3												2	
	2	3	2	3											3	
	3	3													2	
	4	3	2	3											3	
	5	3	2												2	

SYLLABUS

UNIT – I 12 Periods

RAILWAY ENGINEERING – 1: Role of railways in transportation - classification of modes - Comparison of railway and highway transportation - Historical development of railways in India - Advantages of Railways – Classification of Indian Railways – Engineering Surveys for Track Alignment – Obligatory points – Gauges in railway track - Permanent way - Components and their functions – Types of Rails - Rail joints – Welding of Rails – Creep of Rails – Rail fixtures & Fastenings - Coning of Wheels.

UNIT – II 12 Periods

RAILWAY ENGINEERING – 2: Track alignment – requirements of good alignment, factors in selection of good alignment; Geometric design of the track – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

UNIT – III 12 Periods

RAILWAY ENGINEERING – 3: Points and crossings – Necessity – Types, component parts and their functions; Track junctions – types of track junctions; Track drainage – Layout of Railway stations and yards – Signals – Interlocking – Track circuiting – Track Maintenance.

UNIT – IV 12 Periods

AIRPORT ENGINEERING: Layout of Airports – Components functions – Aircraft characteristics – Airport site selection – Airport obstructions and zoning – Runway design – Visual aids – Air traffic control.

UNIT – V 12 Periods

DOCK & HARBOUR ENGINEERING : Layout of Port components – Functions – Classification of Ports – Site selection – breakwaters - Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – warehouses - Navigational aids.

TEXT BOOKS

1. Saxena S.C and Arora S.P "Railway Engineering", Dhanapat Rai Publications, 7th Edition, (2010)
2. Khanna, S.K. and Arora, M.G. "Airport Planning and Design" Nemchand & Bros., 6th Edition (2017).

REFERENCES

1. K.P.Subramanian (2003), "Highway, Railway, Airport and Harbour Engineering" Scitech Publications (India) Pvt. Ltd.
2. Rangwala S.C & K.S. "Railway Engineering", Charotar Publications, 14th Edition, 2005.
3. Robert M. Horonjeff, "Planning and Design of Airports", Mc Graw Hill Publications, 2008.
4. Chadula, S.P. "Railway Engineering–A text book of Transportation Engineering", S.Chand & Co. Ltd. (2001).
5. Relevant NPTEL Courses.

DISASTER MANAGEMENT

CIV 415 B **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

From this course students will learn the following

1. Learn about the nature of disasters
2. Understand about administrative management of disasters
3. Learn about the importance of pre disaster measures

Course Outcomes:

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

1. Explain the effects of natural and man-made disasters
2. Illustrate the administrative setup and risk management strategies of disasters
3. Select the suitable disaster relief measures with specific considerations
4. Analyse the environmental and health effects of hazards
5. Describe the case studies of natural and man-made disasters across the world

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2											2		
	2	2	2											2		
	3	2	2											2		
	4	2	2											2		
	5	2	2											2		

SYLLABUS

UNIT – I 12 Periods

Disasters - Nature and extent of disasters, Natural disasters like earthquakes, floods, drought, volcanoes, forest fires, hazards, landslides, tsunami, etc. Manmade disasters like chemical and industrial hazards, nuclear hazards, fire hazards etc.

UNIT – II 12 Periods

Disaster Management - Administrative setup and organization, Risk management, strategies of risk reduction, disaster resilience, emergency management programme, Information management.

UNIT – III 12 Periods

Disaster Monitoring & Mitigation - Relief measures (short-term and long-term), financing the relief expenditure, legal aspects, rescue and refugee operations, disaster recovery, mitigation measures.

UNIT – IV 12 Periods

Hazard Analysis - Training of personnel, Emergency facilities and equipment necessary, public awareness creation, Impact of disasters on environment and poverty, health hazards of disasters.

UNIT – V 12 Periods

Case studies - Detailed case studies on Earth-quakes, floods, landslides, industrial hazards and fire accidents in India, INCOIS (Hyd), NIDM (Delhi).

TEXT BOOKS

1. Guptha, H.K. (2003), "Disaster management", University Press, New Delhi, 3Fnd Edition.
2. Singh, R.B (2000), "Disaster management", Rawat Publications, New Delhi, 2nd edition.

REFERENCES

1. Krishnamurthy, R.R (2002), "Disaster Management", University Press, New Delhi, 1st edition.
2. Seetharaman, S (1999), "Construction Engineering and Management", Umesh Publications, New Delhi, 4th Edition.
3. Gupta, M.C (2002), "Manuals on Natural Disaster management in India", National Centre for Disaster Management, IIPA, New Delhi,.
4. Relevant NPTEL Courses

ADVANCED GEOTECHNICAL ENGINEERING

CIV 415 C **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Geotechnical Engineering - I, Geotechnical Engineering - II

Course Objective:

The course content enables students to learn the different advanced techniques in Geotechnical Engineering.

Course Outcomes:

At the end of the course the student will be able to;

1. Explain the basic structure of clay minerals and their identification.
2. Identify expansive soils and related problems and suggest techniques to resolve these problems.
3. Analyse the stability of retaining walls and estimate the factor of safety.
4. Analyse the given sheet pile and determine the embedment depth and also design the components of bracing systems such as load in struts, beams and wales.
5. Explain the types and components of well foundation and remedies to shifting and tilting

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2												2	
	2	2	2												2	
	3	2	2												2	
	4	2	2												2	
	5	2	2												2	

SYLLABUS

UNIT – I 12 Periods

Clay Minerals: Structural units of layer silicates – classification of clay minerals – Intersheet and Inter-Layer bonding – The 1:1 Minerals – Smectite Minerals (Montmorillonite) – Mica like clay minerals (Illite) – other clay minerals (Kaolinite); Identification of clay minerals.

UNIT – II 12 Periods

Foundations in Expansive Soils: Expansive Soils**,** Introduction, active zone, mechanism of swelling, determination of Swelling Pressure, Factors influencing heave, estimation of heave; Identification and classification of expansive soil, Foundation Techniques in expansive soil.

UNIT – III 12 Periods

Retaining structures: Introduction, uses, types, stability analysis and design principles of Gravity retaining walls, backfill drainage.

UNIT – IV 12 Periods

Sheet Pile Walls: Types, Design of cantilever sheet pile walls in granular and cohesive soils; Design of anchored sheet pile walls by free and fixed earth support methods, Rowe's theory of moment Reduction, Design of anchors, Diaphragm Walls – construction, trench cutter.

Braced cuts: Introduction, types of sheeting and Bracing systems, lateral earth pressure on sheeting in sand and clay, Design of components of Bracing systems.

UNIT – V 12 Periods

Well Foundations: Introduction, Caissons, Shapes of well Foundation, Components of Well Foundation, Depth of Well Foundation, Forces acting on Well Foundation, Construction of Well Foundation, Tilting and shifting of Wells.

TEXTBOOKS

1. Narasinga Rao, B.N.D.(2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers.
2. Arora, K.R. (2001), "Soil Mechanics and Foundation Engineering", Standard Publishers, Delhi.

REFERENCES

1. Gopal Ranjan and Rao,A.S.R. (2007), "Basic and Applied Soil Mechanics", New age International (P) Ltd, New Delhi.
2. Murthy, V.N.S. (2009), "A text book of Soil Mechanics and Foundation Engineering", UBS Publishers Distributors Ltd., New Delhi.
3. Punmia, B.C. (1995) "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi.
4. Braja M. Das, (2005), "Fundamentals of Geotechnical Engineering", Thomson Asia Pvt. Ltd., Singapore.
5. Venkatappa Rao G & Suryanarayana Raju GVS (1990), "Engineering with Geosynthetics", Tata McGraw Hill Publishing Co. Ltd.
6. Relevant NPTEL Courses.

SOIL DYNAMICS & MACHINE FOUNDATION

CIV 415 D **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Geotechnical Engineering-II

Course Objectives:

From this course students will learn the following

1. To understand the fundamentals of soil dynamics
2. To know the behaviour of the machine foundations and its design
3. To understand the techniques of isolation

Course Outcomes:
At the end of the course, the students will be able to:

1. Analyse and solve problems of soil subject to vibrations
2. Determine the natural frequency of machine foundation soil system from different theories
3. Explain the methods for determination of dynamic properties of soil
4. Explain the design criteria and principles of various types of machine foundations
5. Explain the principle, types and methods of vibration isolation

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2												2	
	2	2	2												2	
	3	2	2												2	
	4	2	2												2	
	5	2	2												2	

SYLLABUS

UNIT – I 12 Periods

Theory of Vibrations: Free and forced vibrations with and without damping for single mass system with single degree freedom, Logarithmic Decrement and Damping Ratio, Principles of Design of Vibration measuring Devices, Transmissibility of force, vibrations of Two degree freedom system, vibrations of Systems under transient loads.

UNIT – II 12 Periods

Natural frequency of foundation soil system- Barkan's Method, Pressure Bulb Concept, Pauw's Analogy, Tschebetorioff's concept of reduced natural Frequency

UNIT – III 12 Periods

Dynamic Soil Properties: Tests for determination of dynamic soil properties - Cyclic Plate load test, Block vibration test, Up Hole, down Hole and Cross Hole wave Propagation tests, Hammer Test, Resonant Column Test, Seismic Reflection and Refraction tests.

UNIT – IV 12 Periods

Design of Machine Foundations: Types of Machine Foundations, design criteria, Degrees of Freedom of Block foundation, Analysis of Block foundations under sliding, rocking, yawing and coupled motions, Design Aspects and Construction details of foundations for reciprocating and Impact machines.

UNIT – V 12 Periods

Vibration Isolation: Vibration Isolation - Passive and active isolation - use of springs and damping materials construction aspects.

TEXT BOOKS

1. Narasinga Rao, B.N.D.(2015), Soil Mechanics and Foundation Engineering, Chapter-22, Wiley Publishers
2. Srinivasulu, P. and Vaidyanathan, C.V. (2017), “Hand-book of machine foundations”, Structural Engineering research Centre.

REFERENCES

1. Swami Saran (1999), Soil Dynamics and Machine Foundations, Galgotia Publications Pvt Ltd..
2. B M Das, (1992),”Principles of Soil Dynamics”, Thomsons Engineering.
3. Shamsher Prakash, Gopal Ranjan and Swami Saran (1979), Analysis and design of Foundations and Retaining Structure,M/s Saritha Prakashan., Meerut.
4. N. S. V. Kameswara Rao, (1998),”Vibration Analysis and Foundation Dynamics”, Wiley New Delhi.
5. Richart F.E., Hall, J.R. Woods, R.D. (1970), Vibrations of soils and Foundation by Richart Hall, Woods Prentice Hall Inc., New Jersey.
6. Relevant I.S. Codes.
7. Relevant NPTEL Courses.

COMPUTER APPLICATIONS IN CIVIL ENGINEERING-II

CIV 416 – PC **Credits: 1.5**

Instruction: 3 Practicals / week Sessional Marks: 50

End Exam: 3 Hours End Exam Marks: 50

Prerequisites:

Structural Analysis, Reinforced Concrete Structures, Steel Structures

Course Objective:

1. To develop skill to use software to create 2D and 3D models
2. To acquire hands on experience in design and preparation of reinforcement details for concrete / steel structures normally encountered in Civil Engineering practice

Course Outcomes:

1. Analyse & Design various types of Beams
2. Analyse & Design various types of Trusses & Frames
3. Draw the Plan,Section & Elevation of a Building using AutoCAD
4. Develop Models in 2D & 3D using 3D Home Architect.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	3		3	3				3	3			3		
	2	2	3		3	3				3	3			3		
	3	3	2		3	3				3	3			3		
	4	3	2		3	3				3	3			3		

LIST OF EXPERIMENTS

STAAD PRO:

1. Analysis and design of beams (simply support, cantilever and continuous beams)
2. Analysis and design of single storey frame
3. Analysis and design of multi storey frame
4. Analysis and design of 3D portal frame
5. Analysis and design of truss
6. Analysis and design of 2D Gable frame

AUTOCAD

1. Drawing of reinforcement detailing of basic RC structural elements (Beams, Column, Slab, Footing and Staircase)
2. Drawing of isometric projections of standard rolled steel sections

REFERENCES

1. Krishnamoorthy, C.S. and Rajeev, S., Computer Aided Design and Analytical Tools, Narosa, 1993
2. Relevant NPTEL Courses.

TRANSPORTATION ENGINEERING LAB

CIV 417 - PC **Credits: 2**
Instruction: 3 Practicals / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Transportation Engineering – I, Geotechnical Engineering - II

Course Objective:

1. To perform tests on road aggregates.
2. To demonstrate the Marshall Stability test.
3. To perform tests on bitumen.
4. To perform tests on soil.

Course Outcomes:

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

1. Investigate the properties of the aggregates and bitumen using IS code and comprehend and write a report
2. Design of bituminous mix by Marshall Stability test using IRC guidelines
3. Interprete the test results as per IRC and Morth guidelines and apply this knowledge to material selection and engineering design processes.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3		3		3		3	3	3				3	
	2	3	3	3	3		3		3	3	3				3	
	3	3	3		3		3		3	3	3				3	

LIST OF EXPERIMENTS

1. **Testing of Aggregates**: Specific gravity – Sieve Analysis – Shape test – Flakiness Index – Elongation Index – Angularity Number – Aggregate Crushing value – Impact value – Abrasion value – Stripping value & Soundness.
2. **Testing of Bituminous material**: Specific gravity – Penetration value – Viscosity value – Softening point – Ductility value – Flash and Fire point.
3. **Design of bituminous mix by** Marshall Stability Test.

REFERENCES

1. Khanna S. K. & Justo, C. E. G. (1973), "Highway Engineering" Nemchand & Brothers, Roorkee, (3rd Edition).
2. Relevant NPTEL Courses.

IV B.Tech II SEMESTER

Detailed Syllabus

PROFESSIONAL ELECTIVE – III

PRESTRESSED CONCRETE

CIV 422 A **Credits: 3**

Instruction: 3 Lectures / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Pre-requisites:

Strength of materials, Concrete technology, Reinforced Concrete Structures

Course objectives:

The objective of this course is to

1. To know the different pre-stressing systems and the losses in pre-stressing
2. To analyse and design the sections for flexure and shear.
3. To evaluate the stresses at the end blocks of a pre-stressed member

Course Outcomes:

At the end of the Course, the Student will be able to:

1. Explain the principles and methods of prestressed concrete.
2. Analyze prestress losses in concrete members.
3. Perform elastic analysis of prestress concrete sections for flexure.
4. Design prestress concrete sections for flexure and shear.
5. Analyze and design anchorage zones in prestress concrete.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2											3		
	2	2	3	2	3									3		
	3	2	3	2	3									3		
	4	3	3	3	2									3		
	5	2	3	3	3									3		

SYLLABUS

UNIT – I 12 Periods

Introduction

Historic development – General principles of pre-stressing – pre-tensioning and post tensioning – Advantages and limitations of pre-stressed concrete – Materials – High strength concrete and high tensile steel and their characteristics.

Prestressing Methods: I.S.Code provisions, Methods and Systems of Pre-stressing; Pre-tensioning and post tensioning methods – Different systems of pre-stressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford Udall System.

UNIT – II 12 Periods

Losses of Prestress

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

UNIT – III 12 Periods

Analysis of Sections for Flexure

Analysis of sections for flexure; Elastic analysis of concrete beams pre-stressed with straight, Concentric, eccentric, bent and parabolic tendons.

UNIT – IV 12 Periods

Design of Sections for Flexure and Shear

Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses.

UNIT – V 12 Periods

Analysis of End Blocks

Analysis of end Blocks by Guyon's method and Magnel method, Anchorage zone stress – Approximate method of design – Anchorage zone reinforcement – Transfer of pre- stress in pre-tensioned members.

TEXT BOOKS

1. Krishna Raju N. (2012) "Prestressed Concrete", Tata Mc.Graw Hill Publications, 5th Edition.
2. Ramamrutham S. (2015) Prestressed Concrete, Dhanpatrai Publications, 4th Edition.

REFERENCES

1. Lin T.Y, and Ned H. Burns, (2010) "Design of Prestressed Concrete Structures", Wiley Publications
2. Rajagopalan. N (2006) "Prestressed Concrete", Narosa publications, 2nd Edition.
3. I.S. 1343-2012 "Indian Standard Code of Practise for Prestressed Concrete", Bureau of Indian Standards.
4. Relevant NPTEL Courses.

ADVANCED FLUID MECHANICS

CIV 422 B **Credits: 3**

Instruction: 3 Lectures / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Fluid Mechanics – I & Fluid Mechanics – II

Course Objectives:

1. To develop an insight into engineering problems related to fluids.
2. Student is expected to learn about the viscous effects on fluid motion to solve complex problems in engineering.
3. Student shall be able to know different types of fluid flows and apply the principles of conservations of mass, momentum and energy.

Course Outcomes:

By the end of the course the student will be able to

1. Analyse the viscous effects on fluid motion.
2. Compute the forces on submerged bodies and induced drag on bodies.
3. Analyze canal transitions using the principles of momentum and energy conservation.
4. Analyze gradually varied flow in open channels.
5. Analyze unsteady fluid flow in open channels.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3													2
	2	3	3													2
	3	3	3													2
	4	3	3													2
	5	3	3													2

SYLLABUS

UNIT – I 12 Periods

Viscous Effects on Fluid Motion: Navier-Stokes Equations (No Derivation) – N.S. equations for standard cases of Plane Two Dimensional and Axisymmetric Flows. Steady Flow between Parallel Plates- Couette and Poiseuille Flows- Unsteady Laminar Flow Past a Flat Plate,Flow through a Circular Annulus- Flow without and with Pressure Gradient- Hagen-Poiseullie Equation, Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes.

UNIT – II 12 Periods

Drag, Lift & Propulsion: Drag of immersed bodies - Variation of Drag Coefficient with Reynolds Number; Resistance diagram for bodies of revolution- Drag Coefficient of Practical Bodies. Effect of Circulation in Irrotational Flow- Computation of Lift Force- Lift on Airfoil- Lift Coefficient and its Variation with Angle of Attack- Jukowsky Profile- Polar Diagram- Stall - Induced Drag

UNIT – III 12 Periods

Uniform Flow in Open Channels: Uniform Flow Computation- Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow. Determination of Normal Depth and Velocity. Design of Channels for Uniform Flow – Design of Non-erodible Channels (Rectangular & Trapezoidal Sections only). Canal Transitions- Change of Depth in Channels with (a) Change in Cross-section and (b) Hump in the Bed- Control Sections- Venturi Flume and Parshall Flume.

UNIT – IV 12 Periods

Varied Flow in Open Channels: Definition of G.V.F. and Derivation of Governing Equation- Mild, Steep, Critical, Horizontal and Adverse Slopes- Classification of G.V.F. Profiles- Backwater and Drawdown Curves- G.V.F. Profiles for Channels with Changing Slopes. Computation of G.V.F. Profiles- Graphical Integration Method and method of Direct Integration (Procedures Only), Direct Step and Standard Step Methods – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only).

UNIT – V 12 Periods

Unsteady Flow in Open Channels: Gradually Varied Unsteady Flow –Dynamic Equation for Unsteady Flow – Monoclinical Rising Wave –Dynamic Equation for Uniformly Progressive Flow. Wave Profile of Uniformly Progressive Flow- Dam Break Problem - Wave Propagation.(Solution of Unsteady-flow equations and Spatially varied Unsteady Flow are excluded). Rapidly Varied Unsteady Flow - Uniformly Progressive Flow – Moving Hydraulic jump – Positive and Negative Surges–Pulsating Flow.

TEXT BOOKS

1. Modi, P.N.& Seth, S.M. (2009),"Fluid Mechanics and Hydraulic Machinery", Standard Book House, New Delhi, 19th Edition.
2. Subramanyam, K. (2008), "Flow in Open Channels", McGraw Hill Education, New Delhi, 3rd Edition.

REFERENCES

1. Jain, A.K. (2008), "Fluid Mechanics", Khanna Publishers, New Delhi, 4th Edition.
2. Kumar, K.L., Chand, S. & Co. (2008), "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi, 8th Edition.
3. Chow, V.T. (2009), "Open-Channel Hydraulics", The Blackburn Press, Caldwell, NJ USA, 1st Edition
4. White, F. M. (2011) "Fluid Mechanics", Tata McGraw Hill Publication, New Delhi, 7th Edition.
5. Relevant NPTEL Courses.

ADVANCED DESIGN OF STRUCTURES

CIV 422 C **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Strength of materials, Concrete technology, Reinforced Concrete Structures, Steel Structures

COURSE OBJECTIVES:

From this course students will learn the following

1. To learn how to design RCC water tanks and Concrete bridges
2. To learn how to design plate girders
3. To analyse beams and frames

COURSE OUTCOMES:

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

1. Explain the principles of working stress method, design and draw the reinforcement detailing of beams, underground water tanks and tanks resting on ground.
2. Design and draw the reinforcement detailing of RCC overhead water tanks.
3. Design and draw the reinforcement detailing of RCC concrete bridges.
4. Design and draw the detailing of plate girders.
5. Analyse beams and frames by applying the concept of plastic analysis.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	2										2		
	2	2	2	2										2		
	3	2	2	2										2		
	4	2	2	2										2		
	5	2	2											2		

SYLLABUS

UNIT – I 12 Periods

Introduction To Working Stress Method: Introduction – Design for bending –Analysis and design of singly reinforced and doubly reinforced beams.

Rectangular RC Water Tanks-I: Introduction – General design requirements according to Indian standard code of practice – Design of on ground and underground water tanks.

UNIT – II 12 Periods

Rectangular RC Water Tanks-II: Introduction – General design requirements according to Indian standard code of practice –Design of over head water tanks.

UNIT – III 12 Periods

RC Bridges: Components of a bridge in sub structure and super structure. Classification of bridges. Loads on Highway bridges, IRC loading, Design of slab bridge.

UNIT – IV 12 Periods

Steel Bridges: Bridges: Classification, Loadings, Types of bridges – Deck Type and Through Type, Design of Through Type Bridge - Stringer, Cross Girders.
Bearings & Expansion Joints: Types of bearings, plate bearing, Rocker bearing, Roller bearing, Knuckle pin bearing. Expansion Joints: Introduction and classification.

UNIT – V 12 Periods

Plastic analysis: Introduction, Upper and Lower bound theorems, Uniqueness theorem, Shape factor, Load factor; Collapse load for fixed and continuous beams, Collapse load for a frame of single bay single storey frame.

TEXT BOOKS

1. Punmia, B.C , Ashok Kumar Jain and Arun Kumar Jain,(2016) "Limit State Design of Reinforced Concrete " Laxmi Publications (P) Ltd. New Delhi, 16th Edition
2. Duggal, S.K. (2014) "Limit State Design of steel structures", McGraw Hill Education Private Ltd.

REFERENCES

1. Varghese, P.C., (2009) " Advanced Reinforced Concrete Design", Prentice Hall of India Pvt.Ltd, New Delhi
2. Ramamrutham, S. (2015) "Design of Reinforced Concrete Structures", Dhanpat Rai publishing company (P) Ltd.
3. Pillai, S.U. & Devdas Menon, (2009) "Reinforced concrete design", Tata McGraw Hill. New Delhi, Third Edition.
4. Jain, A.K., (2016) "Reinforced Concrete Design", Charotor Publications. Anand Gujarat, 16th Edition
5. Subramanian, N. (2011) "Design of Steel structures", Oxford University Press.
6. Relevant Indian Standard Codes
7. Relevant NPTEL Courses

GROUND IMPROVEMENT TECHNIQUES

CIV 422 D **Credits: 3**

Instruction: 3 Lectures / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objective

The course content enables students to learn the different techniques for enhancing the properties of soil.

Course Outcomes

At the end of the course the student will be able to;

1. Illustrate various methods of ground improvement and their suitability to different field conditions.
2. Classify different types of Grouting Techniques and their sequence of operation
3. Outline the applications of Vertical Drains and their construction practices.
4. Describe the Types, Functions and Applications of Geosynthetics and identify their Properties.
5. Explain the Types, Objectives and methods of Dewatering Techniques

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3												3	
	2	3	3												3	
	3	3	3												3	
	4	3	3												3	
	5	3	3												3	

SYLLABUS

UNIT – I 12 Periods

Introduction – Need for Ground Improvement, Objectives of Ground Improvement, Classification of Ground Improvement Methods, Mechanical Stabilization- Triangular Chart Method and Rothfutch Method, Blasting, Dynamic Compaction/ Consolidation.

Cement stabilization- Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques.

UNIT – II 12 Periods

Soil & Foundation Grouting – Grouting Equipments, Applications, Classification of grouting based on Materials, Grouting Technique and Sequence of Operation.

UNIT – III 12 Periods

Vertical Drains- Preloading, Sand Drains, Prefabricated - Principle, Band Drains or Wick Drain, , Advantages and Disadvantages, Stone columns - Introduction, construction practice, design principles, vibrofloatation techniques and other techniques like dynamic replacement etc.

UNIT – IV 12 Periods

Reinforced Earth – Concept, Materials and Applications.
Geosynthetics-Types, Functions, Applications and Durability
Properties of Geotextiles- Physical, Mechanical and Hydraulic Properties

UNIT – V 12 Periods

Reinforced Earth – Materials, Applications.
Dewatering- Definition, Objectives, Methods of Dewatering- Open Sumps and Ditches, Well point Systems, Deep Well Systems, Vertical Sand Drains, Electro- Osmosis, cut-off walls.

TEXTBOOKS

1. Narasinga Rao B.N.D (2015), Soil Mechanics and Foundation Engineering, Wiley Publishers, pp. 963-1038, 1st Edition.
2. Purushothama Raj P. (1999), Ground Improvement Techniques, Lakshmi Publications, New Delhi.

REFERENCES

1. Hausmann Manfred R. (1990), Engineering Principles of Ground Modification, McGraw-Hill.
2. Moseley, M.D. (1998), Ground Treatment, Blackie Academic and Professional.
3. Venkatappa Rao, G. and Suryanarayana Raju, G.V.S. (1990), “Engineering with Geosynthetics”, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE-IV

WATERSHED MANAGEMENT

CIV 423 A **Credits: 3**

Instruction: 2 Lectures & 1 Tutorials / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Water Resources Engineering – I

Course Objectives:

From this course students will be able to

1. Understand the concept of watershed management
2. Identify the characteristics of watershed
3. Study the principle of soil erosion and methods controls soil erosion
4. Study different techniques for water harvesting
5. Study different factors responsible for land management

Course Outcomes:

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

1. Explain objectives and concept of watershed management
2. Analyse watershed characteristics to take appropriate management action
3. Select a suitable erosion control method for the given site conditions
4. Describe the techniques for conservation of water.
5. Summarize land use and land capability methods and techniques for reclamation of soils

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2													2
	2	2	2													2
	3	2	2													2
	4	2	2													2
	5	2	2													2

SYLLABUS

UNIT – I 12 Periods

Introduction: Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.

UNIT – II **12** periods

Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

UNIT – III 12 Periods

Principles of Erosion: Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation.
Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, Gabion.

UNIT – IV **12** Periods

Water Harvesting: Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

UNIT – V **12** Periods

Land Management: Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

TEXT BOOKS

1. Murthy, J. V. S, (2006) "Watershed Management" New Age International Publishers, New Delhi
2. Murthy, V.V.N (2007) "Land and Water Management" Kalyani Publications, New Delhi

REFERENCES

1. Das M.M. and Saikia M.D (2013) "Watershed Management", PHI Learning Pvt. Ltd
2. Wurbs R A and James R A (2002) "Water Resource Engineering", Prentice Hall Publishers Upper Saddle River, N.J.
3. Black P E (1996) "Watershed Hydrology" Prentice Hall, Upper Saddle River, N.J.
4. Relevant NPTEL courses.

ADVANCED BUILDING CONSTRUCTION

CIV 423 B **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

From this course students will learn the following

1. Learn about advanced developments in building constructions
2. Understand the role of technology in building constructions
3. Learn about the modern electrical installations

Course Outcomes:

At the end of the course, the students will be able to

1. Analyse building configuration by applying the Concepts of Earthquake Engineering
2. Analyse Various Fire zones by Applying the concepts of Fire Resistance of materials
3. Plan aganist Outdoor & Indoor Noises in a building
4. Apply the concept of Smart Systems in Building
5. Analyse the different Electrical Installations, Lifts & Escalators for various types of structures

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2											2		
	2	3	2											2		
	3	3												2		
	4	3												2		
	5	3	2											2		

SYLLABUS

UNIT – I 12 Periods

Earthquake resistant buildings: Occurrence of earthquakes, plate-tectonic theory, seismic waves, magnitude and intensity, seismic zones of India, plan & vertical configurations of buildings, shear walls, dampers, base-isolation, strong column-weak beam concept.

UNIT – II 12 Periods

Fire resistant buildings: Introduction, Importance of fire resistance to buildings, ISO 834 standard heating conditions, grading or classifications, effect of high temperature on steel and concrete, effect of high temperature on different types of structural members.
Fire protection of buildings: Fire zones, general requirements, exit requirements, requirements of residential, educational, business, industrial and storage buildings

UNIT – III 12 Periods

Acoustic buildings: planning and design against outdoor and indoor noise for - residential, educational, office, hostel and industrial buildings.
Thermal Insulated buildings: Introduction, designating thermal properties, Insulation materials, construction techniques for thermal insulation, super Insulation.

UNIT – IV 12 Periods

Smart buildings: materials used in smart systems, different types of smart materials, characteristics and behaviour of smart materials, Components of smart systems, system features and interpretation of sensor data, features of control systems.

UNIT – V **12** Periods

Electrical installations: general requirements, planning of electrical installations for earthing, tele-communication and other miscellaneous services
Installations of lifts & Escalators: essential requirements, design considerations for lifts and escalators

REFERENCES

1. Pankaj Agarwal (2011), "Earthquake Resistant Design of structures", Prentice Hall of India, New Delhi, 2nd edition.
2. Varghese,P.C (2009), "Advanced Reinforced Concrete Design" , Prentice Hall of India, New Delhi, 2nd edition.
3. SP-7 (1983), National building code of India,Group-1, part-4&8
4. Srinivasan, A. V and Michael McFarland, D (2000), "Smart Structures: Analysis and Design", Cambridge University Press, New Delhi, 1st edition.
5. William Spence, P (2012), "Construction materials, methods and Techniques", Cengage learning India pvt ltd, New Delhi, 2nd edition.
6. Relevant NPTEL Courses.

EARTHQUAKE ENGINEERING

CIV 423 C **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Course Objective:

1. To create a strong understanding on application of single degree and multi-degree of freedom systems.
2. To impart the knowledge on causes and effects of earthquakes.
3. To familiarize with seismic codal and detailing provisions.

Course Outcomes:

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

1. Explain the basic concepts related to earthquake engineering.
2. Analyse problem on structures subjected to vibrations.
3. Apply various concepts related to plan configurations to a framed structure having plan irregularities.
4. Illustrate the structural detailing of structures affected by seismic forces.
5. Explain various methods adopted in strengthening and retrofitting of structures.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2		1				1						1		
	2	2		1				1						1		
	3	2		1				1						1		
	4	2		1				1						1		
	5	2		1				1						1		

SYLLABUS

UNIT – I 12 Periods

Introduction: Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic Regions, Intensity and Iso-seismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zones.

UNIT – II 12 Periods

Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Un damped and damped free vibration, Multiple Degree of Freedom (MDOF) Systems Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode shapes

UNIT – III 12 Periods

Plan Configurations – Torsion Irregularities – Re-entrant corners – Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of adjacent buildings.

UNIT – IV 12 Periods

Ductile Detailing: Ductility of R.C structures- Confinement- detailing as per IS-13920-1993- moment redistribution – principles of design of beams, columns – beam column joints – soft story concept.

UNIT – V 12 Periods

Cyclic loading behaviour of RC and steel elements, Base isolation, Retrofitting and restoration of buildings subjected to damage due to earthquakes, effects of earthquakes, factors related to building damages due to earthquake, methods of seismic retrofitting, restoration of buildings.

TEXT BOOKS

1. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2007, New Delhi.

REFERENCES

1. Chopra A.K., “Dynamics of Structures”, 5th Edition, Pearson Education, Indian Branch, Delhi, 2007
2. Duggal, S.K. “Earth Quake Resistant Design of Structures”, Oxford university Press, 1st Edition, 2012
3. IS Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.
4. Relevant NPTEL Courses.

ENVIRONMENTAL IMPACT ASSESSMENT

CIV 423 D **Credits: 3**

Instruction: 2 Lectures & 1 Tutorials / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Environmental Sciences.

Course objectives:

The objectives of this course are to

1. To study about the basics, methods of assessment and importance of Environmental Impact Assessment.
2. To know about the Environmental Management and Prediction Methods
3. To study about the Environmental Management Plan
4. The broad education necessary to understand the impact of engineering solutions in global economic, environmental and social context

Course outcomes:

By the end of the course the students will be able to

1. Explain the importance of Environmental Impact Assessment
2. Describe the effect of a activities on various environmental attributes
3. Identify and Analyse Environmental Impacts of projects
4. Evaluate the criteria for selection of method
5. Analyse impact studies and demonstrate control measures

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2													2
	2	2	2													2
	3	2	2													2
	4	2	2													2
	5	2	2													2

SYLLABUS

UNIT – I 12 Periods

Introduction: Introduction to EIA. Definition of E IA and EIS, preparation of EIS, Elements of EIA, Agency Activities, Environmental setting.

UNIT – II 12 Periods

Environmental attributes: Environmental attributes, air, water, soil, ecology, noise Socio-Economic aspects, Culture and human aspects (Human Settlements-Rehabilitations)

UNIT – III 12 Periods

Environmental impacts: Identification, measurement, Aggregation, Secondary and Cumulative Impacts.

UNIT – IV 12 Periods

Impact Assessment Methodologies: Criteria for selection of methodology, impact assessment methodologies, procedure for reviewing environment impact statement.

UNIT – V 12 Periods

Case studies: Economic impact analysis, energy production impact analysis, cost benefit analysis, Environmental impact mitigation and control measures.

TEXT BOOKS

1. Ravi Jain, Urban, L.V., Gary S. Stacey and Harold Balbach (2001), "Environmental Impact Analysis", McGraw Hill Professional, New York, 2nd Edition.
2. Anjaneyulu, Y., Valli Manickam (2011), "Environmental Impact Assessment Methodologies", B.S. Publication, New Delhi, 2nd Edition.

REFERENCES

1. Larry W. C. (1996), "Environmental Impact Analysis", Mc. Graw Hill Publishers, New York, 2nd Edition.
2. John Glasson, Riki Therivel and Andrew Chadwick. (2005), "Introduction to Environmental Impact Assessment" Routledge Publication, London, 3rd Edition.
3. Relevant NPTEL Courses.

AIR POLLUTION CONTROL

CIV 423 E **Credits: 3**

Instruction: 2 Lectures & 1 Tutorials / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Environmental Sciences

Course Objectives:

The objective of this course is to:

1. To impart the knowledge on air pollution.
2. To analyse causes and effects of air pollution.
3. To familiarize with strategic planning for control of air pollution.

Course Outcomes:

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

1. Identify the Sources of Air pollutants and its classification.
2. Analyse meteorological parameters and its effect on air pollutants
3. Predict various effects of air pollutants on humans, animals, plants and materials in terms of health, safety, societal and cultural issues
4. Analyse suitable control equipment for gaseous air pollutants
5. Analyse suitable control equipment for particulate air pollutants

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3														1
	2	2	3													2
	3	1	2	3			1									3
	4	2	3													2
	5	2	3													2

SYLLABUS

UNIT – I 12 Periods

Air Pollution and its definition, Factors influencing air pollution, Classification of pollutants particulates, Sources of pollution, Air qualities standards, effects.

UNIT – II 12 Periods

Meteorology: Wind rose diagrams, lapse rates, mixing depth, atmospheric dispersion, plume behaviour, Effective stack height, stack monitoring and ambient air quality monitoring.

UNIT – III 12 Periods

Air Pollution effects: On human beings, animals, plants and materials, Air Pollution Episodes in India (Kanpur, Delhi and Agra) and abroad (London, Beijing).

UNIT – IV 12 Periods

Control of air pollution (Gaseous): Air pollution control equipment's (units) such as setting chamber, cyclones, electrostatic precipitators, after burners, absorption, adsorption, Diffusion.

UNIT – V 12 Periods

Control of air pollution (Particulate): Air pollution control equipment's (units) such as wet scrubbers/collectors, scrubbers, centrifugal scrubbers, spray towers, packed beds.

TEXT BOOKS

1. Rao, M.N. and Rao, H.V.N. "Air Pollution", Tata McGraw Hill Company.
2. Elements of Air Pollution Control by Prof. T. Shivaji Rao
3. Murali Krishna, K.V.S.G. "Air pollution", Kaushal Publications – Kakinada.

REFERENCES

1. Air Pollution Control Technology by T. Painter.
2. Wark and Warner, "Air pollution", Harper & Row, New York.
3. Air Pollution Control by K.V.S.G. Murali Krishna.
4. Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H.
5. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - V

OPTIMIZATION TECHNIQUES

CIV 424 A **Credits : 3**

Instruction : 3 Lectures / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

1. To learn about different approaches in civil engineering.
2. To known about formulation of the problem.
3. To understanding problem solution by Linear programming method, duality theory and sensitivity analysis.
4. To know various applications of linear programming with respect to civil engineering.

Course Outcomes:

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

1. Explain the basics of formulation of structural optimization problems.
2. Explain different linear programming methods
3. Apply Linear programming methods to optimal structural design problems.
4. Apply optimization techniques in problems related to various specializations in civil engineering
5. Analyse the different methods for nonlinear programming for optimization in civil engineering

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2												1		
	2	2												1		
	3	2												1		
	4	2												1		
	5	2												1		

SYLLABUS

UNIT – I 12 Periods

Introduction to planning and optimization - Planning process - systems - Systems approach in Civil Engineering - Principles of modelling.

UNIT – II 12 Periods

Linear programming - Formulation of the problem - Graphical solution

UNIT – III 12 Periods

Solution methods of linear programming problems - Standard form of linear programming problems - Simplex method - Simple problems.

UNIT – IV 12 Periods

Applications of linear programming in civil engineering - Transportation - Construction– Structural Design - Pipe network - Water resource planning.

UNIT – V 12 Periods

Non-Linear programming: Deterministic Methods - Unconstrained and constrained Optimization - Kuhn-Tucker conditions, Direct search and gradient methods - One dimensional search methods - DFP and BFGS algorithms.

TEXT BOOKS

1. Rao. S.S, (2014), "Engineering optimization", Fourth edition, John Wiley & Sons.
2. Kranthiswamy, (2016), "Operations Research Perspectives", Elsevier.

REFERENCES

1. Haftka, R.T. and Gurdal, Z., (1992),"Elements of Structural Optimization", Third Revised Edition, Kluwer Academic Publishers.
2. Arora, J.S, (2004), "Introduction to Optimum Design", Second Edition, Elsevier.

Relevant NPTEL Courses.

RS & GIS APPLICATIONS IN CIVIL ENGINEERING

CIV 424 B **Credits : 3**

Instruction : 3 Lectures / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Nil

Course Objectives:

1. To Learn about the principles of remote sensing and Electromagnetic radiations
2. To know about satellites, satellite parameters
3. To learn about the image interpretation and processing techniques
4. To study about GIS and various data models.
5. To know the applications of remote sensing and GIS in civil engineering projects.

Course outcomes:

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

1. Explain various ranges of spectrum in Electro Magnetic Radiation
2. Demonstrate the working principles of satellites.
3. Interpretate and analyse the images from GIS Analysis
4. Describe overlay operations of maps in GIS
5. Apply the tools of GIS in various civil engineering applications

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3											2	2	
	2	3	3											2	2	
	3	3	3											2	2	
	4	3	3											2	2	
	5	3	3											2	2	

SYLLABUS

UNIT – I 9 Periods

Remote Sensing – Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface, Energy sources and radiation principles.

UNIT – II 9 Periods

Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of sensor systems used in RS, RS satellites, land sat, spot, IRS, IKONOS, QUICKBIRD., RS data products.

UNIT – III 9 Periods

Image interpretation - Elements of image interpretation, concepts of digital image processing image Rectification and Restoration, Image enhancement, Image classification. Characteristics of different platforms, Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems.

UNIT – IV 9 Periods

Introduction, GIS overview, Introduction to GIS - elements of GIS, Computer hardware - Software. Data Input, Verification, data storage and database management and output applications, Map Overlay - Vector and raster data model , overlay operation Errors and quality control.

UNIT – V 9 Periods

RS and GIS in civil engineering projects: Soil mapping and characteristics. Application in water resource engineering. Environmental pollution monitoring. Regional and urban mapping, planning systems and waste disposal sites.

TEXTBOOKS

1. Lillesand, T.M. & Kiefer R.W. (2007), "Remote Sensing and image interpretation", John Wiley & Sons (Asia), Newyork.

REFERENCES

1. Anji Reddy, M. (2011), "Remote sensing and Geographical information system", B.S Publications.
2. Burrough, P. A. (1998), "Principles of Geographical information systems for land resource assessment", Clarendon Press, Oxford, 2nd Edition.
3. Stan Aronoff, (1991), "Geographic Information Systems - A Management Perspective", WDL Publications, Ottawa, Canada, Reprint Edition.
4. Kennie, J.J.M., Matthews, (2005), "Remote sensing in Civil Engineering", Mc-Millan.
5. Floyd F. Sabins, (2005), "Remote Sensing Principles and Interpretation", Jr. W.H. Freeman & Co., 3rd Edition.
6. Relevant NPTEL Courses.

BRIDGE ENGINEERING

CIV 424 C **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Design of Concrete Structures

Course Objective:

1. Familiarize Students with different types of Bridges and IRC standards
2. Equip student with IRC standards
3. Equip student with concepts and design of Slab Bridges
4. Equip student with concepts and design of T Beam Bridges
5. To familiarize student with the knowledge of bridge sub structure

Course Outcomes:

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

1. Explain different types of Bridges with diagrams
2. Describe the different Loading standards
3. Analyse and design the Slab bridges,
4. Analyse and design the T Beam bridges
5. Perform the stability analysis of Substructure

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3												2		
	2	2	2											2		
	3	2	2	3										2		
	4	2	2	3										2		
	5	2	3	2										2		

SYLLABUS

UNIT – I 12 Periods

Introduction: Components of Bridges – Classification – Importance of Bridges -Selection of Bridge site – Economical span – Location of piers and abutments – Choice of bridge type: Subsoil exploration – Scour depth. Importance of Bearings

UNIT – II 12 Periods

Loading Standards: Types of loading - Dead load - Live load (IRC Standards) - Impact Load - Tractive forces - Centrifugal forces - wind forces – temperature stresses – Seismic forces.

UNIT – III 12 Periods

Slab bridges-introduction- Wheel load on slab- effective width method (IS Method) - slabs supported on two edges- cantilever slabs- dispersion length

UNIT – IV 12 Periods

Beam & Slab Bridge (T-Beam Girder Bridge): General features – Design of interior panel of slab – Pigeaud's method – Courbon's method – Analysis and design of T-beam longitudinal girder subjected to IRC loading – Analysis and design of Cross Girder

UNIT – V 12 Periods

Substructure: General features of Abutments – forces acting on abutments – Design and Stability analysis of abutments. General features - Types of piers – Forces acting on piers – Design and Stability analysis of piers. Types of Bearings.

TEXT BOOKS

1. Johnson victor D, "Essentials of Bridge Engineering", 7th Edition, Oxford, IBH publishing Co., Ltd., 2006.
2. Ponnuswamy, S. (2008), "Bridge Engineering" Mc Graw Hill Inc.

REFERENCES

1. Krishna Raju N., "Design of Bridges", 4th Edition, Oxford and IBH Publishing Co., Ltd., 2008.
2. Jagadish T.R. & M.A. Jayaram, "Design of Bridge Structures", 2nd Edition, 2009
3. Relevant – IRC & Railway bridge Codes.
4. Relevant NPTEL Courses.

INTRODUCTION TO FINITE ELEMENT METHOD

CIV 424 D **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Course Objective:

1. To study the strain- displacement and linear constitutive relation.
2. To understand the numerical techniques applied in FEM Establishment of element stiffness and load vector.
3. To study about the 2-D isoperimetric concepts.

Course Outcomes:

On completion of the course, the student will be able to:

1. Derive the differential equilibrium equations for various elements
2. Analyse stresses and strains for various elements
3. Analyse plane stress/strain conditions for triangular and quadrilateral elements
4. Compute the stiffness matrix for isoperimetric elements
5. Construct finite element models for simple elements under different load conditions

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	3											2		
	2	2	3											2		
	3	2	3											2		
	4	2	3											2		
	5	2	2											2		

SYLLABUS

UNIT – I 12 Periods

Introduction Of Finite Element Method – Concept of an element – Various element shapes**.**

UNIT – II 12 Periods

Displacement Models – Element stresses and strains – Direct formulations of element stiffness and loads**.**

UNIT – III 12 Periods

Plane stress/strain triangular elements – Quadrilateral elements – Modelling and mesh refinement**.**

UNIT – IV 12 Periods

Construction of stiffness matrix and loads – boundary conditions**.**

UNIT – V 12 Periods

Finite Element modelling and solution techniques – symmetry in Finite Element method– nature of Finite Element method solution – errors– convergence and adaptively.

TEXT BOOKS

1. Krishnamurthy, C.S, (1995), “Finite Element Analysis Theory & Programming”, McGraw-Hill.
2. Bhavikatti, S.S. (2015), “Finite Element Analysis”, New Age International Pvt. Ltd

REFERENCES

1) Zienkiewcz, O.C., and Taylor, R.L., (2002), “The Finite Element method”, Butterworth Heinemann, New Delhi.
2) Cook, R.D., (2002), “Concept and Applications of Finite Element Analysis”, John Wiley & Sons.
3) Chandrakant. S. Desai, and John. F. Abel.,(2002), “Introduction to the Finite Element method”, CBS Publishers & Distributors, New Delhi.
4) Chandraputla, T.R. and Belegundu A.D., (2003), ”Introduction to Finite Elements in Engineering”, Prentice Hall, Indian, Edn.
5) Relevant NPTEL Courses

ENGINEERING ECONOMICS & FINANCE

CIV 424 E **Credits: 3**

Instruction: 2 Lectures & 1 Tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objective:

To explain the basic principles of managerial economics, accounting practices and financial management techniques for effective business decision making and to promote entrepreneurial abilities among the budding engineers.

Course Outcomes:

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

1. Assess the quantifying alternatives by applying compounding factors and cashflow diagrams
2. Recommend the best option through analysing the alternatives by Present, Future and Annual worth methods
3. Choose the best alternative by Performing Break-even, Benefit-Cost and Capitalized cost analysis
4. Apply the concepts of depreciation and equipment economics
5. Differentiate types of financial estimates and their suitability for effective financial management

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2									3				
	2	2	2									3				
	3	2	2									3				
	4	2	2									3				
	5	2	2									3				

SYLLABUS

UNIT – I 12 Periods

Engineering economics :Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A,A/P), Future payment compared to uniform series payments (F/A,A/F),Arithmetic gradient, Geometric gradient.

UNIT – II 12 Periods

Comparison of alternatives – I: Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return.

UNIT – III 12 Periods

Comparison of alternatives – II: Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.

UNIT – IV 12 Periods

Depreciation, Inflation and Taxes: Depreciation, Inflation, Taxes.
Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

UNIT – V 12 Periods

Cost estimating: Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, parametric estimate and Life cycle cost.
Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

Note: The student is expected to gain only elementary knowledge of the subject. Numerical Problems are for Internal Valuation only.

REFERENCES

1. Bulu Pradhan, "Construction Economics and Finance", NPTEL Course, IIT Guwhati.
2. Peterson, S. J., 2011, "Construction Accounting and Financial Management", Pearson Education, Upper Saddle River, New Jersey,
3. Blank, L.T. and Tarquin, A.J., 2011 "Engineering Economy", Seventh Edition, WCB/McGraw-Hill,.
4. Bose, D. C., 2010 "Fundamentals of Financial management", 2nd ed., PHI, New Delhi.
5. Gould, F. E., 2002 "Managing the Construction Process", 2nd ed., Prentice Hall, Upper Saddle River, New Jersey.