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RAMDEOBABA UNIVERSITY, NAGPUR
Formerly Shri Ramdeobaba College of Engineering & Management (RCOEM) Est. 1984
LEARN | INNOVATE | ACCOMPLISH

**RAMDEOBABA UNIVERSITY
NAGPUR-440013**

School of Engineering Sciences

PROGRAMME SCHEME & SYLLABI

2024-2025 I Year

2025 –2026 II Year

2026-2027 III Year

B.Tech. (CIVIL& INFRASTRUCTURE ENGINEERING)

Shri Ramdeobaba University, Nagpur.
Department of Civil Engineering
Teaching and Evaluation Scheme B.Tech (Civil&InfrastructureEngineering) NEP-2020 based
To be implemented from Session: 2024-25

Semester – I

Course Code	Category	Name of Course	Lecture (Hours)	Practical (Hours)	Credits	CA	ESE/Internals Evaluation	Total	ESE Duration
24HS05TH0101	BSC-T	Physics for Civil Engineering	3	0	3	50	50	100	3
24HS05PR0101	BSC-P	Physics for Civil Engineering Lab	0	2	1	25	25	50	-
24HS03TH0101	BSC-T	Calculus, Probability and Statistics	3	0	3	50	50	100	3
24ES01TH0101	ESC-T	Engineering Mechanics	3	0	3	50	50	100	3
24ES01TH0102	ESC-T	Application of python in Civil Engineering	2	0	2	50	50	100	2
24ES01PR0103	ESC-P	Computer Programming for Civil Engineers	0	2	1	25	25	50	-
24ES01TH0104	ESC-T	Building Materials & Components	1	0	1	25	25	50	-
24ES01PR0105	VSEC-P	Engineering Drawing and Drafting (AutoCAD)	0	4	2	25	25	50	-
24HS02TH0101	AEC-T	English for Professional Communication	2	0	2	50	50	100	2
24HS02PR0101	AEC- P	English for Professional Communication Lab	0	2	1	25	25	50	-
24HS02PR0105	CC-P	Liberal/Performing Art	0	2	1	0	0	0	-
24HS02TH0104	VEC	Foundational Course in Universal Human Values	1	0	1	25	25	50	-
			15	12	21	400	400	800	

*List of Liberal/Performing Art courses are enclosed

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Syllabus and Scheme for Liberal/Performing Arts Basket

Sr. no.	Course Code	Course Title	Lecture	Practical	Credits	Continuous Evaluation	End Sem Exam/ Internal Evaluation	Total	ESE Duration
1.	24HS02PR0105-01	Fundamentals of Indian Classical Dance: Bharatnatayam	0	2	1	25	25	50	N/A
2.	24HS02PR0105-02	Fundamentals of Indian Classical Dance: Kathak	0	2	1	25	25	50	N/A
3.	24HS02PR0105-03	Introduction to Digital Photography	0	2	1	25	25	50	N/A
4.	24HS02PR0105-04	Introduction to Basic Japanese Language	0	2	1	25	25	50	N/A
5.	24HS02PR0105-05	Art of Theatre	0	2	1	25	25	50	N/A
6.	24HS02PR0105-06	Introduction to French Language	0	2	1	25	25	50	N/A
7.	24HS02PR0105-08	Art of Painting	0	2	1	25	25	50	N/A
8.	24HS02PR0105-09	Art of Drawing	0	2	1	25	25	50	N/A
9.	24HS02PR0105-10	Nature Camp	0	2	1	25	25	50	N/A
10.	24HS02PR0105-11	Developing Self-awareness	0	2	1	25	25	50	N/A
11.	24HS02PR0105-12	Art of Poetry	0	2	1	25	25	50	N/A
12.	24HS02PR0105-13	Creative and Content Writing	0	2	1	25	25	50	N/A
13.	24HS02PR0105-14	Science of life through Bhagwad Gita	0	2	1	25	25	50	N/A
14.	24HS04PR0102-1	Adventure Sports	0	2	1	25	25	50	N/A
15.	24HS04PR0102-2	Introduction to Defense Forces & Obstacle Training	0	2	1	25	25	50	N/A
16.	24HS04PR0102-3	Self Defense & Indian Martial Arts	0	2	1	25	25	50	N/A
17.	24HS04PR0102-4	Basic Nutritional Course	0	2	1	25	25	50	N/A
18.	24HS01PR0103	Introduction to Remedies by Ayurveda	0	2	1	25	25	50	N/A
19.	24HS01PR0104	Biodegradation of Kitchen Waste	0	2	1	25	25	50	N/A
20.	24HS05PR0105	Herbal Home Remedies: A Course for Self-Care	0	2	1	25	25	50	N/A
21.	24EE07PR0105	Day-to-Day Electrical Systems	0	2	1	25	25	50	N/A

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Semester-II									
Course Code	Category	Name of Course	Lecture	Practical	Credits	CA	ESE	Total	ESE Duration
24HS01TH0201	BSC-T	Engineering Chemistry for Civil Engineers	3	0	3	50	50	100	3
24HS01PR0201	BSC-P	Engineering Chemistry for Civil Engineers Lab	0	2	1	25	25	50	-
24HS03TH0216	BSC-T	Linear Algebra and Multivariate Calculus	3	0	3	50	50	100	3
24ES01TH0201	ESC-T	Basics of Geotechnical Engineering	3	0	3	50	50	100	3
24ES01PR0201	ESC-P	Basics of Geotechnical Engineering Lab	0	2	1	25	25	50	-
24ES01TH0202	PCC-T	Solid Mechanics	3	0	3	50	50	100	3
24ES01PR0202	PCC-P	Solid Mechanics Lab	0	2	1	25	25	50	-
24ES01TH0203	VSEC-T	Building Services	3	0	3	50	50	100	3
24HS02TH0205	IKS-T	Foundational literature for Indian civilization	2	0	2	50	50	100	2
24HS04PR0202	CC-P	Sport-Yoga-Recreation	0	2	1	25	25	50	-
			17	08	21	400	400	800	

Exit Option

Option 1	Infrastructure/Real Estate/Industry Internship (1 Month)	0	0	8	Industry Internship completion certificate along with report
Option 2	Mini Project with report(1 Month)	0	0	8	Mini project report to be assessed by supervisor

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Semester-III

Course Code	Category	Name of Course	Lecture	Practical	Credits	CA	ESE	TOTAL	ESE Duration
24ES01TH0301	PCC-T	Fluid Mechanics	3	0	3	50	50	100	3
24ES01PR0301	PCC-P	Fluid Mechanics Lab	0	2	1	25	25	50	-
24ES01TH0302	PCC-T	Concrete Technology	3	0	3	50	50	100	3
24ES01PR0302	PCC-P	Concrete Technology Lab	0	2	1	25	25	50	-
24ES01TH0303	PCC-T	Structural Analysis	3	0	3	50	50	100	3
24ES01PR0303	PCC-P	Structural Analysis Lab	0	2	1	25	25	50	-
24ES01TH0304	VEC-T	Technical Report Writing	1	0	1	50	0	50	-
24ES01TH0305	MDM-T	List attached	3	0	3	50	50	100	2
24ESOEC01TH0308	OE-T	Open Elective - I	2	0	2	50	50	100	2
24ES01TH0306	MGM T-T	Finance Management for Civil Engg. projects	2	0	2	50	50	100	2
24ES01PR0307	FP-P	Mini Project& Field visit	0	4	2	50	0	50	-
			17	10	22	475	375	850	

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Semester-IV

Course Code	Category	Name of Course	Lecture	Practical	Credits	CA	ESE	TOTAL	ESE Duration
24ES01TH0401	PCC-T	Water Supply Engineering	3	0	3	50	50	100	3
24ES01PR0401	PCC-P	Water Supply Engineering Lab	0	2	1	25	25	50	-
24ES01TH0402	PCC-T	Reinforced Concrete Structures	3	0	3	50	50	100	3
24ES01TH0403	PCC-T	Basics of Surveying	2	0	2	50	50	100	2
24ES01PR0403	PCC-P	Basics of Surveying Lab	0	2	1	25	25	50	-
24ES01TH0404	MDM-T	List attached	3	0	3	50	50	100	3
24ESOE01TH0408	OE-T	Open Elective - II	3	0	3	50	50	100	3
24ES01TH0405	AEC-T	Concrete Mix Design	1	0	1	50	0	50	0
24ES01TH0406	MGMT-T	Construction Engineering & Management	3	0	3	50	50	100	3
24ES01PR0407	VSEC	Computational Tools for Civil Engineering	0	2	1	50	0	50	0
			18	6	21	450	350	800	

Option 1	Infrastructure/Real Estate/Industry Internship (1 Month)	0	0	8	Industry Internship completion certificate along with report
Option 2	Mini Project with report (1 Month)	0	0	8	Mini project report to be assessed by supervisor

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Semester-V

Course Code	Category	Name of Course	Lecture	Practical	Credits	CA	ESE	TOTAL	ESE Duration
24ES01TH0501	PCC-T	Transportation Engineering	3	0	3	50	50	100	3
24ES01PR0501	PCC-P	Transportation Engineering Lab	0	2	1	25	25	50	-
24ES01TH0502	PCC-T	Waste Water Engineering	3	0	3	50	50	100	3
24ES01PR0502	PCC-P	Waste Water Engineering Lab	0	2	1	25	25	50	-
24ES01TH0503	PCC-T	Estimating & Costing	3	0	3	50	50	100	3
24ES01TH0504	PCC-T	Advanced Concrete Structures	3	0	3	50	50	100	3
24ES01TH0505	PEC-T	Program Elective-T	4	0	4	50	50	100	3
24ES01TH0506	MDM-T	List attached	3	0	3	50	50	100	3
24ESOEC01TH0507	OE-T	Open Elective - III	2	0	2	50	50	100	2
			21	4	23	400	400	800	

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Semester-VI

Course Code	Category	Name of Course	Lecture	Practical	Credits	CA	ESE	TOTAL	ESE Duration
24ES01TH0601	PCC-T	Design of Steel Structures	3	0	3	50	50	100	3
24ES01TH0602	PCC-T	Foundation Engineering	2	0	2	50	50	100	2
24ES01TH0603	PCC-T	Flow through pipes & channels	3	0	3	50	50	100	3
24ES01PR0603	PCC-P	Flow through pipes & channels Lab	0	2	1	25	25	50	-
24ES01TH0604	PEC-T	Program Elective - II	3	0	3	50	50	100	3
24ES01PR0604	PEC-P	Program Elective – II Lab	0	2	1	25	25	50	-
24ES01TH0605	PEC-T	Program Elective - III	3	0	3	50	50	100	3
24ES01PR0606	PCC-P	Technical Drawing Analysis &Evaluation	0	2	1	50	-	50	-
24ES01TH0607	MDM-T	List Attached	3	0	3	50	50	100	3
24ES01PR0608	VSEC-P	Quality Control in Construction Processes	0	2	1	50	0	50	0
24ES01PR0609	CCA-P	Simulation in Civil Engineering	0	2	1	50	-	50	0
			17	10	22	500	350	850	

Exit Option

Option 1	Infrastructure/Real Estate/Industry Internship (1 Month)	0	0	8	Industry Internship completion certificate along with report
Option 2	Minor Project with report (1 Month)	0	0	8	Mini project report to be assessed by supervisor

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Semester-VII/VIII

Course Code	Category	Name of Course	Lecture	Practical	Credits	CA	ESE	TOTAL	ESE Duration
24ES01TH0701	PEC-T	Program Elective - IV	3	0	3	50	50	100	3
24ES01PR0701	PEC-P	Program Elective – IV Lab	0	2	1	25	25	50	-
24ES01TH0702	PEC-T	Program Elective - V	4	0	4	50	50	100	3
24ES01TH0703	PEC-T	Program Elective - VI	3	0	3	50	50	100	3
24ES01TH0704	PCC-T	Hydrology and Water Resources Engineering	3	0	3	50	50	100	3
24ES01PR0705	Project-P	Minor Project	0	8	4	50	50	100	0
24ES01TH0706	CCA	Participative Learning	1	0	1	50	-	50	0
24ES01TH0707	CCA	Property Documentation for Civil Engineers	1	0	1	50	-	50	0
			15	10	20	375	275	650	12

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Semester-VIII/VII												
Course Code	Category	Name of Course	Lecture		Practical	Credits	Theory Course				Practical Course	
							CA	ESE	TOTAL	ESE Duration	CA	ESE
Option 1 - Project												
24ES01P R0801	VEC/ Project-P	Major Project	0		12	6	0	0	0	0	100	100
24ES01T H0802	PCC-T	Contracts Account and Work Management	3		0	3	50	50	100	3	0	0
24ES01T H0803	PCC-T	Irrigation Engineering	3		0	3	50	50	100	3	0	0
			6		12	12	100	100	200	6	100	100
Option 2 – Industry Internship												
24ES01P R0804	II-P	Industry Internship	0		24	12	0	0	0	0	100	100
Option 3 - Research Internship												
24ES01P R0805	RI-P	Research Internship	0		18	9	0	0	0	0	100	100
24ES01T H0806	PCC	Research Methodology	3		0	3	50	50	100	3	0	0
			3		18	12	50	50	100	3	100	100
Option 4 - TBI Internship												
24ES01P R0807	TBI	TBI Internship	0		24	12	0	0	0	0	100	100

Breakup of Semester wise Credits

Semester	Lecture	Practical	Credits
1	15	12	21
2	17	08	21
3	17	10	22
4	18	6	21
5	21	4	23
6	17	10	22
7	15	10	20
8	6	12	12
Total	126	72	162

Program Elective courses basket

Semester		Construction Management	Environmental Engineering	Structural Engineering	Geotechnical Engineering	Transportation Engineering	General	Water Resources
V	(PE-I)(T)	Advanced Concrete Technology	Air Pollution & Control	Advanced Structural Analysis	Geotechnical Explorations	Railway Engineering	Engineering Geology	Urban Drainage and Sewage System
VI	(PE-II)(T&P)	Advanced Construction Techniques	Industrial Waste Water Treatment	Retrofitting & Rehabilitation of Civil Infrastructure	Ground Improvement	Traffic Engineering and Management	Computer Aided Design and Drafting (CADD)	Water Transmission & Distribution System
	(PE-III)(T)	Urban Infrastructure	Solid Waste Management	Prestressed Concrete Structures	Advanced Geotechnical Engineering	Pavement Design	Infrastructure Planning and Management	Introduction to Piping and Plumbing Engineering
VII	(PE-IV)(T&P)	Advance construction Materials	Water and waste water Treatment	Earthquake Resistant Design of RCC Structures	Reinforced Earth	Urban Transportation Planning	BIM	Integrated Water Resources Management
	(PE-V)(T)	Contracts Management	Environmental Management	Bridge Engineering	Special Geotechnical Constructions	Airport Planning and Design	Numerical Method for Civil Engineers	Open Channel Hydraulics
	(PE-VI)(T)	Digital Technologies for Civil Engineers	Environmental System Modeling	Advanced Steel Structures	Earth and Rockfill Dams	Highway Construction And Management	Remote sensing and GIS	Watershed Conservation and Management

Sr. No	Semester	Open Electives
1	III	1) Construction Aspects of Formwork 2) Formwork Systems 3) Design of Formwork System
2	IV	1) Introduction to Programming with MATLAB 2) Linear Regression and Modeling
3	V	1) Construction Cost Estimating and Cost Control 2) Construction of Metro Rail Systems 3) Planning of Metro Rail Systems

Participative Learning 1 Credit (12-14 Hours minimum)

Short Course, Workshop, Hands-on-training, Training Program, MOOC Courses of 1 Credit (contents are beyond regular curriculum), Participation in competitions, Laboratory based Experimental Learning, Modelling of prototype, Filing/Grant of Design Patent/Copyright, any other work relevant to program certified by concerned faculty.

MDM (Multi-Disciplinary Minor) courses Scheme
Track: Civil Engineering for Sustainable Development

Sr. No.	Sem	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuo usEvalu	End SemE xam	Total	
1	III	25ES01TH0305	Fundamentals of Civil Infrastructure and Construction	3	0	0	3	50	50	100	3
2	IV	25ES01TH0404	Construction Materials and Technology	3	0	0	3	50	50	100	3
3	V	25ES01TH0506	Green Building Construction and Environmental Systems	3	0	0	3	50	50	100	3
4	VI	25ES01TH0607	Building Construction Methods and Management	3	0	0	3	50	50	100	3
			TOTAL	12	0	0	12				

**NPTEL courses provision for Fast Learners
(any 5 courses to be completed, to earn 15 credits)**

Discipline	Course Name	SME Name	Institute	Co-ordinating Institute
Civil Engineering	Air pollution and Control	Prof. Bhola Ram Gurjar	IITR	IITR
Civil Engineering	Engineering Hydrology	Prof. Sreeja Pekkatt	IITG	IITG
Civil Engineering	Bridge Engineering	By Prof. Piyali Sengupta	IIT (ISM) Dhanbad	(ISM) Dhanbad
Civil Engineering	Geotechnical Engineering II Foundation Engineering	Prof. Dilip Kumar Baidya	IITKGP	IITKGP
Civil Engineering	Urban Transportation Systems Planning	Prof. Bhargab Maitra	IITKGP	IITKGP
Civil Engineering	Analysis and Design of Bituminous Pavements	M. R. Nivitha (MRN) Neethu Roy (NR) A. Padmarekha (APR) J. Murali Krishnan (JMK)	IITM	IITM
Civil Engineering	Energy Efficiency, Acoustics and Daylighting in Building	Prof. B. Bhattacharjee	IITD	IITD
Earth Sciences	Remote Sensing and GIS for rural development	Prof. Pennan Chinna samy	IITB	IITB
Architecture, Civil and Design	Strategies for Sustainable Design	Prof. Shiva Ji	IIT Hyderabad	IITM
Multidisciplinary	Multi-Criteria Decision Making and Applications	Prof. Raghu Nandan Sengupta	IITK	IITK

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Honors Teaching and Evaluation Scheme

Course Code	Name of Course	Lecture	Practical	Credits	CA	ESE	TOTAL	ESE Duration
24ES01HT0301	Construction Technology	3	0	3	50	50	100	3
24ES01HT0401	Fire fighting system	3	0	3	50	50	100	3
24ES01HT0501	Geotechnical Design	3	0	3	50	50	100	3
24ES01HP0501	Geotechnical Design Lab	0	2	1	25	25	50	-
24ES01HT0601	Foundation Design	3	0	3	50	50	100	3
24ES01HP0601	Foundation Design Lab	0	2	1	25	25	50	-
24ES01HP0701	Project	0	8	4	0	0	0	0
	Total	12	10	18	250	250	500	12

Minor Teaching and Evaluation Scheme

Course Code	Name of Course	Lecture	Practical	Credits				
					CA	ESE	TOTAL	ESE Duration
24ES01MT0301	Sustainable Engineering	3	0	3	50	50	100	3
24ES01MT0401	Disaster Management	3	0	3	50	50	100	3
24ES01MT0501	Engineering Ethics and Professional Practice	3	0	3	50	50	100	3
24ES01MP0501	Engineering Ethics and Professional Practice Lab	0	2	1	25	25	50	
24ES01MT0601	Basics of Civil Engineering	3	0	3	50	50	100	3
24ES01MP0601	Basics of Civil Engineering Lab	0	2	1	25	25	50	
24ES01MT0701	Project	0	8	4	0	0	0	0
	Total	12	12	18	250	250	500	

"Titles of Certificates or Degrees upon Completion of Each Year in Bachelor of Technology (B.Tech) Civil Engineering"

- 1) After 1st year exit :Certificate course in Civil and Infrastructure Engineering
- 2) After 2nd year exit : Advanced Certificate course in Civil and Infrastructure Engineering
- 3) After 3rd year exit : Diploma in Civil and Infrastructure Engineering
- 4) After 4th year exit :B.Tech in Civil & Infrastructure Engineering

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Department of Civil Engineering

Syllabus for Semester B.Tech V

Course Code: 25ES01TH0501 Course Name: Transportation Engineering

L : 3 Hrs., P :2 Hrs., Per Week Credits: 4

Course Outcomes: After successful completion of the course, the student will be able to;

CO1: **Explain** the principles of highway development and planning, road classification, network patterns, and the requirements and surveys involved in highway alignment.

CO2: **Apply** principles of geometric design to determine cross-sectional elements, sight distances, and alignment features such as horizontal and vertical curves.

CO3: **Analyze and design** flexible and rigid pavement systems by evaluating pavement types, material behaviour, axle loading, and pavement design parameters using standard methods.

CO4: **Evaluate** the engineering properties of highway materials and **assess** suitable construction methods, pavement performance, failures, maintenance, and strengthening measures.

CO5: **Analyze** traffic characteristics and traffic study data, and **design/propose** appropriate traffic control and highway management measures for safe and efficient transportation systems.

Unit I

Highway Development & Planning

Principles of Highway planning, Road development in India, Classification of roads, network patterns, Planning, Surveys. Highway Alignment: Requirements, Engineering Surveys.

Unit II

Highway Geometric Design

Cross Section elements, carriageways, camber, stopping & overtaking sight Distances, Horizontal alignment- Curves, design of super elevation, widening, transition curves, vertical curves.

Unit III

Pavement Design

Types of pavements & characteristic, Design parameters, Axle & Wheel load, tyre pressure, ESWL for dual Wheels, repetitions, Group Index & IRC method of flexible pavement design. Analysis of load &

temperature stresses of rigid pavement, joints.

Unit IV:

Highway Construction materials, methods & Maintenance

Highway Materials: Properties of sub grade and pavement component materials, Tests on subgrade soils, aggregates and bituminous materials. Application of Geosynthetics, Earthen/Gravel road, Water Bound Macadam, Wet Mix macadam, Bituminous pavement, Cement Concrete pavement. Pavement failures, maintenance and strengthening measures.

Unit V

Traffic Engineering

Traffic characteristics (Road User, Driver and Vehicular characteristics), Traffic Studies (Volume studies, speed studies, parking studies and accident studies), Traffic Safety (Causes and types of accidents, Use of intelligent transportation system), Traffic controls (Road markings, Traffic signs, traffic signals)

Unit VI:

Modern Highway Design Practices

Introduction to IRC latest codes, Intelligent Transport Systems (ITS), Adaptive traffic signals and smart intersections, Introduction to mechanistic-empirical pavement design, Perpetual pavements and rigid pavement innovations

Text Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised, 10th Edition, Nem

Chand & Bros, 2017

2. Kadiyalai, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers.

3. Partha Chakraborty and Animesh Das 'Principles of Transportation Engineering, PHI Learning,
4. SrinivasaKumar, R,Textbook ofHighway Engineering,UniversitiesPress, 2011.

ReferenceBooks

1. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition,2009.
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and TrafficAnalysis',4thEdition,JohnWiley

Course Code: 25ES01PR0501 Course Name: Transportation Engineering lab

Course Outcomes: After successful completion of the course, the student will be able to;

C01: **Perform** laboratory tests on subgrade soils such as CBR and AASHTO classification and **record** observations systematically for pavement applications.

C02: **Conduct and analyze** tests on aggregates including specific gravity, water absorption, crushing value, abrasion value, and impact value to **assess** their suitability for pavement construction.

C03: **Perform and interpret** tests on bituminous materials such as penetration, softening point, ductility, and specific gravity to **evaluate** their engineering properties.

C04: **Analyze and evaluate** stabilized soil behavior, bituminous mix design, and stripping characteristics to ensure durability and performance of pavement systems.

C05: **Compile, analyze, and present** laboratory results in technical reports and **recommend** suitable materials, mix designs, and road construction practices using appropriate highway construction machinery.

Test on Soil

1. CBR Test
2. AASHO Classification of Soil Subgrade
3. Tests on Stabilized soil

Test on Aggregate

1. Specific Gravity & Water Absorption
2. Crushing Value test on Aggregate
3. Abrasion Value test on Aggregate
4. Impact Value test on Aggregate

Test on Bitumen

1. Penetration Test
2. Softening Point Test
3. Ductility Test
4. Specific gravity of bitumen

Study experiments

1. Bituminous Mix Design
2. Road Construction Machineries
3. Bitumen Extraction Test
4. Stripping Test on Bituminous Mix

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0502 Course Name: Waste Water Engineering

L : 3 Hrs., P : 2 Hrs., Per Week Credits: 4

Course Outcomes

The students would be able to,

1. Understand and evaluate the necessity of wastewater and sanitation management along with the basic knowledge of collection methodology, treatment processes and disposal methods.
2. Understand and analyse requirements of various components of wastewater treatment scheme for efficient operation and maintenance of the scheme.
3. Analyze various sewer appurtenantes, sewer designs, sludge and rural sanitation systems
4. Evaluate different characteristics of wastewater and analyze wastewater treatment methods.
5. Apply the knowledge of various principles, theories and equations in process analysis and in the design of various components of sewerage system

Unit I:

General Aspects of waste water sanitation and treatment: Necessity of sanitation and treatment,

classification of waste water, system of sanitation, patterns of sewage collection systems.

Estimation of storm water and sanitary waste water.

Conveyance of sewage: Types, hydraulic design of sewer.

Unit II:

Laying of sewer: Procedure for laying of sewer to grade, testing of sewer line.

Sewer Appurtenances: Manhole, street inlets, storm water overflows, inverted syphons, flushing,

ventilation, drop manhole, lamp hole, clean out and catch basin.

House plumbing systems: Ideal requirements of HPS, types of HPS, anti-syphonage.

Unit III:

Characteristics of sewage: Physical, chemical and biological characteristics of wastewater and its

significance, BOD rate constant, BOD equation and its application to simple analysis.

Rural sanitation: Pit privy, aqua privy, bio-gas recovery. Septic tank including soak pit, (including design problem), sullage collection and disposal.

Wastewater treatment: Wastewater treatment flow sheet and its site selection,

Unit IV:

Preliminary treatment: Screens, Grit chambers

Primary treatment: Primary Settling Tank (including simple design).

Unit V:

Secondary treatment: Types of secondary treatment, principle of biological treatment, aerobic

and anaerobic treatment processes, activated sludge process and trickling filter.

Treatment of sludge: sludge digestion, sludge drying beds.

Disposal of wastewater: Disposal standards, disposal by dilution, disposal by land treatment.

Text Books :

1. B.C.Punmia," Waste Water Engineering" - Laxmi Publication
2. G.S.Birdie, "Water Supply & Sanitary Engineering"- Dhanpat Rai Publishing Company (P)
Ltd.
3. Metcalf & Eddy, “Wastewater Engineering: Treatment and Resource Recovery”
Publisher:
McGraw Hill.
4. S.J. Arceivala, “Wastewater Treatment and Disposal”, Marcel Dekker,1981.
5. Fair G M, Geyer J C and Okun, “Water and Wastewater Engineering”, Vol II, JohnWiley Publications, 1969

Reference Books :

1. S. K. Garg, Environmental Engineering Vol-II (Khanna Publication)
2. Davis & Cornwell, Introduction to Environmental Engineering, McGraw Hill, International,
1998.
3. CPHEEO manual on sewerage and sewage treatment

Course Code: 25ES01PR0502 Course Name: Waste Water Engineering Lab

Course Outcomes:

The student would be able to:

1. Understand and evaluate the significance of various characteristics of wastewater along with the knowledge of disposal standards
2. Analyze various characteristics of wastewater.
3. Understand the necessity of wastewater treatment.
4. Analyze and interpret experimental data obtained from wastewater samples and suggest the type of treatment required for its safe disposal.
5. Remember and understand various principles and instruments used in wastewater analysis.

PRACTICALS:

Minimum Eight Experiments

1. To determine oil & grease content of a given wastewater sample using separating funnel
2. To determine optimum coagulant dosage using Jar test apparatus
3. To determine of TDS of given sample using TDS meter
4. To determine moisture content of given sample as per IS 1350:1984 (BIS 1984).
5. To determine ash content and volatile matter and fixed carbon content of given sample as per IS 1350:1984 (BIS 1984).
6. To determine sludge volume index (SVI) in the given wastewater sample.
7. To determine calcium and magnesium ions present in the given sample.
8. To determine Mixed liquor suspended solids and mixed liquor volatile suspended solids of a given wastewater sample.

9. To determine the Biochemical oxygen demand (BOD) of a given wastewater sample.
10. To study the determination of Chemical Oxygen Demand (COD) of a given wastewater sample
11. To determine percentage of available chlorine in given sample containing bleaching powder.
12. To determine sulphates using spectrophotometer.
13. To determine turbidity of a solution using Nepheloturbidimeter.

Text Books :

1. B.C.Punmia, " Waste Water Engineering" - Laxmi Publication
2. G.S.Birdie, "Water Supply & Sanitary Engineering"- Dhanpat Rai Publishing Company (P)
Ltd.
3. Metcalf & Eddy, "Wastewater Engineering: Treatment and Resource Recovery"
Publisher:
McGraw Hill.
4. S.J. Arceivala, "Wastewater Treatment and Disposal", Marcel Dekker, 1981.
5. Fair G M, Geyer J C and Okun, "Water and Wastewater Engineering", Vol II, John Wiley Publications, 1969

Reference Books:

1. Standard Methods for the Examination of Water and Wastewater, American Public Health
Association, American Water works Association, Water Environment Federation.
2. Civil Engineering Department, RCOEM, Laboratory Manual.
3. CPHEEO manual on sewerage and sewage treatment.
4. IS 3025: 1987 Methods of sampling and test (physical and chemical) for water and

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0503

Course Name: Estimation & Costing

L : 3 Hrs., P : Hrs., Per Week

Credits: 3

Course Outcomes

The students should be able to,

1. Read the drawings, understand the details, identify the appropriate items and calculate the quantity of items involved in civil Engineering work including earthwork of road / canal and reinforcement of RCC members by applying the basic principles of computation.
2. Prepare an approximate and detailed estimate of load bearing & framed structure and various civil engineering works. Evaluate the financial aspect of the project.
3. Draft the specifications of various items involved in civil engineering works considering the object, type and principles of specification. Analyze the unit rate of item referring to the specification of item and local or regional current market rates of materials and labors.
4. Prepare contract documents, float tender and select proper agency for execution of work according to types of contract. Supervise the work, prepare bills and maintain the accounts of works. Collect logical information and evaluate the present fair value of property for various purposes of valuation & Fixation of standard rent.

UNIT I

Definition and Purpose of estimate, Mode and Unit of measurement of various items as per IS1200 , Work charge establishment, Contingencies, PWD as construction agency, Technical sanction, Administrative approval, Price escalation, Current schedule of rates .

Types of estimate, Objective, use and methods of approximate estimate, Estimate of earthwork of road & canal.

Detailed estimate of RCC members with detailed calculation of reinforcement and bar bending Schedule.

UNIT II

Methods of detailed estimate Detailed estimate of building for RCC framed structure.

UNIT III

Contract, Contract documents, essentials of contract, major conditions of contract & clauses, Types of contract with advantage & disadvantage and its suitability, Earnest money and Security deposit.

Tender notice, Tender documents, Types of tender, Acceptance and rejection of tender, unbalanced tender, Pre-qualification & Post qualification of contractor, Drafting of short tender notice, Liquidated damage, arbitration.

UNIT IV

Specification definition, Objectives, Principles of writing specification, Sources of information, Types of specifications, developing and drafting of detailed specifications of important items of building and road works.

Rate Analysis: Definition, Purpose, factors affecting, Task works per day, Rate analysis of important items of work.

UNIT V

Valuation: Purpose, Factor affecting, Cost, price & value, Definition of various values used, Freehold & lease hold property, Methods of valuation of property, valuation of residential building

Outgoing, gross income, net income, sinking fund, rent fixation, obsolescence, capitalized value, year purchase.

Text Books

M. Chakraborti, Estimating, costing, specification and valuations in civil engineering, edition 2010 and latest, UBS publication Calcutta.

References

B. N. Dutta, Estimating and costing, Publisher S. Dutta & company lucknow, Feb 1999 edition. UBS publisher distributors Ltd, 5, Ansari road, New Delhi.

S. P. Chandola & V.N. Vazirani, Estimating and costing, Edition 2010 and latest, Khanna Publishers, 2-B, Nath market, Noida, Delhi.

S.C. Rangwala Estimating Costing and valuation, edition 2011, Charotar publishing house, opposite Amul dairy, Court road Anand.

D. D. Kohli, Estimating costing and accounts (civil), 10th edition, S Chand and company.

Roshan Namavati, Valuation of Real Properties

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Department of Civil Engineering

Syllabus for Semester B.Tech V

Course Code: 25ES01TH0504

Course Name: Advanced Concrete Structures

L :3 Hrs., P : Hrs., Per Week Credits: 3

On completion of the course, the students:

1. Will demonstrate the ability to understand the behavior and modes of failure of reinforced concrete members such as statically indeterminate continuous beams, short and slender columns, biaxially bent columns, footings (single and combined), staircases and retaining walls etc.
2. Will demonstrate the ability to analyze and design reinforced concrete members such as statically indeterminate continuous beams, short and slender columns, biaxially bent columns, footings (single and combined), staircases and retaining walls etc.
3. Will demonstrate the ability to relate the knowledge and design skills taught in class to real world problems & implement the technique in designing.

Unit I : Limit state of collapse in flexure: Analysis and design of doubly reinforced rectangular, T and L section Limit state collapse in Torsion: Concept of interaction of torsion, shear and flexure, analysis and design of rectangular sections for torsion, shear and flexure. Limit state of serviceability: Deflection calculations for beams and one way slabs.

Unit II : Moment redistribution, analysis and design of fixed beams, propped cantilever, two span symmetric continuous beam.

Unit III : Analysis and design of columns subjected to biaxial moments, design of long columns Analysis and design of portal frames (single bay single storey), hinged or fixed at base, design of hinge and design of foundation.

Unit IV : Design of isolated footings for uniaxial and biaxial bending for square, rectangular and circular section Design of combined footing Rectangular footing Strap beam footing Trapezoidal footing Raft footing

Unit V : Design of RCC two way slab with various end conditions using with IS code coefficient. Design of RCC cantilever and counter fort retaining wall.

Reference Books :

1. Illustrated Design of RC Buildings by V. L. Shah and S. R. Karve, Standard Publisher
2. Reinforced concrete design by S. Sinha , Tata McGraw Hill Publications
3. Fundamentals of RC Design, M. L. Gambhir, PHI Learning Pvt. Ltd.
4. Limit State Design of Reinforced concrete, P. C. Varghese, PHI Learning Pvt. Ltd.
5. RCC Design, Menon & Pillai, Tata McGraw- Hill publications
6. Limit state Design of reinforced conc. (As per IS 456:2000), Dr. BC Punmia, A.K. Jain, Laxmi publications.
7. Reinforced Concrete: Limit State Design, Ashok K. Jain, Nem Chand Publishers.
8. Practical Design of Reinforced Concrete Structures, Ghosh Karuna Moy, PHI Learning Pvt. Ltd.
9. Limit State Theory and Design

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-1 Course Name: Advanced Concrete Technology

L :4 Hrs., P : Hrs., Per Week

Credits: 4

Course Outcome

1. The students will be able to understand the microstructure of the hydration product of cement.
2. The students will be able to analyse and interpret fresh and hardened properties of concrete.
3. The students will be able to demonstrate different types of concrete with its properties and uses.
4. The students will be able to explore to use methods for concrete mix design with quality control approach.

Unit I

Structure of Concrete : Introduction, Structural Levels, Structure of Concrete in Nanometer Scale: C – S – H Structure, Transition Zone in Concrete, Micro-structural Engineering

Unit II

Fresh Concrete : chemical and physical processes of hydration and interaction; Admixtures: Review of types and classification; chemical composition; origin and manufacture; actions and interactions; usage; effects on properties of concretes, methods of test; applications.

Rheology of concentrated suspensions, pastes, mortars and concretes; workability, segregation and bleeding. Theory and principles governing the correct placing and compaction of concrete.

Unit III

Hardened Concrete: Strengths of Hardened Concrete, Stress – Strain Relationship and Constitutive Equations, Dimensional Stability—Shrinkage and Creep, Durability Impact, Dynamic and fatigue behaviour of concrete, behaviour of concrete under fire.

Unit IV

Fiber-Reinforced Cementitious Composites, High-Strength Cementitious Composites, Polymers in Concrete, Shrinkage-Compensating Concrete, Self-Compacting Concrete, Engineered Cementitious Composite, High-Volume Fly Ash Concrete, Structural Lightweight Concrete, high grade concrete

Unit V

Concrete Fracture Mechanics: Introduction, Linear Elastic Fracture Mechanics, The Crack Tip Plastic Zone, Crack Tip Opening Displacement, Fracture Process in Concrete.

Non Destructive Testing : Rebound hammer, UPV and core test (method of testing, calculation of output and the interpretation of results)

Unit VI

Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method.

Quality control and quality assurance of concrete, selection of control procedures, Measures of dispersion, Acceptance criteria, Quality management in concrete construction, probability and sampling theory, tests of significance, curve fitting and regression, repeatability and reproducibility, control charts. Role and limitations of statistics in concrete technology.

References

1. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2006.
2. Orchard D.F., Concrete Technology -Vol I., Applied Science Publishers (Fourth Edition) 1979.
3. Neville A.M and J.J. Brook; Properties of Concrete, Addison Wesley 1999.
4. Advance Concrete Technology by Zongjin Li, Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-2 Course Name: Air pollution & control

L :4 Hrs., P : Hrs., Per Week

Credits: 4

Course Outcomes

The students would be able to:

1. Understand and describe various types of air pollutants and its sources, air pollution parameters,

Effects of air pollutants.

2. Determination techniques of air pollutants along with the importance of meteorological parameters in air pollution. methods of sampling and analysis of air pollutants

3. Knowledge about Control of various air pollutants methodology and modelling.

4. Knowledge of noise pollution its management and control.

Unit I

Introduction to air pollution, Air pollutants, Sources, classification, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects- Smoke, smog and ozone layer disturbance, Greenhouse effect.

Unit II

Meteorological parameters affecting air pollution, Micrometeorological processes lapse rate and

atmospheric stability, plume behavior, wind rose, pollution rose, Stack height computation, Regional air quality models, Source inventories and significance, Gaussian and other dispersion model.

Unit III

Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations,

control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods.

Unit IV

Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters,

electrostatic precipitators, scrubbers and other removal methods like absorption, adsorption,

precipitation etc. Biological air pollution control technologies, Indoor air quality.

Unit V

Noise pollution : Sources, Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels, calculation of weighted noise level index; plane, point and line sources, multiple sources; outdoor and indoor noise propagation, effects of noise on health, annoyance rating schemes;

Unit VI

Introduction to vehicular pollution, special noise environments; noise standards and limit values; noise instrumentation and monitoring procedure, Noise indices, Noise management and control methods.

Text Books

1. Rao M.N. and Rao H.V. N, Air Pollution, Tata Mc-Graw Hill Publishing Co. New Delhi, Third Edition, 1992.
2. Rao C.S., Environmental Pollution Control Engg, New Age International Pvt. Ltd. Publishers, 2006.
3. Y. Anjaneyulu, A textbook of air pollution & control technology, Allied publishers
4. Environmental Noise Pollution – PE Cuniff, McGraw Hill, New York, 1987

References

1. Air Pollution, NEERI Manual.
2. Nevers N.D, Air Pollution control Engineering, Editions Civil Engineering series, 1995.
3. Stern A. C, Air pollution, Tata McGraw Hill International, Vol I to IX

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Department of Civil Engineering

Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-3 Course Name: Advanced Structural Analysis

L :4 Hrs., P : Hrs., Per Week

Credits: 4

Course Outcome

On completion of the course students will be able to;

1. know the deflected shape of structures for understanding response due to various loads.
2. analyze the beam and frames for vertical and horizontal loads and draw SFD and BMD.
3. calculate forces in members of truss due to load by stiffness method.
4. analyze the non-prismatic beam for understanding its behavior

Syllabus

Approximate Method structural analysis for multistoried frames with lateral loads (portal and cantilever method), Approximate methods for vertical loads i.e. Substitute method etc. (Max three bay three storeys)

Analysis of non-prismatic fixed beams by **Column analogy Method**, Application to beams, Calculations of stiffness factors and carryover factors for non-prismatic member.

Introduction to **Flexibility Method** of structural analysis, influence coefficients, Choice of base determinate structure and redundant forces, compatibility equations and solution of simple beam problems with sinking effect, up to 3 degree of indeterminacy.

Basic concept, Degree of Freedom. Formulation of elemental/local stiffness matrix and global stiffness matrix for **Plane Truss**. Transformation Matrix, Assembly of Global/ Structural stiffness matrix up to (8x8). Member load matrix including lack of fit, temperature,

Assembly of Global/ Structure load matrix, Solution to problems with maximum degree of freedom three.

Formulation of element/local **Stiffness Matrix** and global stiffness matrix for beam members (without axial deformations) for **Continuous Beams**, Assembly of global/ structural stiffness matrix, Member load matrix due to various type of loading, Assembly of global/ structure load matrix up to Three Elements. Solution to problems with maximum degree of freedom Three.

Formulation of element/ local Stiffness Matrix and global stiffness matrix for **Plane frame** members (without axial deformations), Transformation matrix Assembly of global/ structural stiffness matrix, Member load matrix due to various type of loading, temperature, Assembly of global/ structural load matrix. Solution to Plane frame problems with maximum degree of freedom three. Introduction to FEM

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-4

Course Name: Geotechnical Explorations

L :4 Hrs., P : Hrs., Per Week

Credits: 4

Course Outcomes

1. Students will able to identify and determine the properties of soil.
2. Students will understand the principles of exploration, Methods of exploration,
3. Students will analyses the advance methods of exploration.
4. Students will able to undertake various field techniques and its interpretations.
5. Students will able to prepare the geotechnical exploration report.

Unit I

IMPORTANCE AND OBJECTS OF GEOTECHNICAL EXPLORATION:

Principle methods of subsurface exploration as per IS 1892, Methods of open exploration its suitability. Types of borings, selection of suitable boring method; stabilization of boreholes; number, location and depth of boring for different structures, Types of soil samples & their suitability, precautions in sampling, parameter for sampler design, Planning of subsurface exploration program for major civil engineering projects

Unit II

INDIRECT METHODS OF EXPLORATION:

Seismic refraction method, electrical resistivity method, qualitative and quantitative interpretation of test results, limitations.

Unit III

FIELD INVESTIGATION (Sampling Method):

Standard Penetration test as per IS2131, Static Cone and dynamic cone penetration tests as

per IS 4669.3, interpretation of test results and correlations for obtaining design soil parameters of cohesive and cohesion less soil. Determination of bearing capacity by above criteria.

Unit IV

FIELD INVESTIGATION (In-situ Method):

Field vane shear test, Plate load test as per IS 1888, Pressure meter test – Principle, equipment, use & interpretation of results.

Unit V

ROCK TESTING

Test conducted on rocks, Core, RQD, underwater sampling, Soil survey and Mapping: methods of soil survey introduction of remote sensing.

Unit VI

REPORT & INSTRUMENTATION

Sub-surface Investigation Report: Salient features and boring logs; boring and sampling records handling Advance Equipment's used in boring and samplings.

Text Books:

1. Basic and Applied soil mechanics: Gopal Ranjan & A.S. Rao, New Edge International Ltd., (2004)
2. Soil Mechanics and Foundation Engineering: K.R. Arora, Standard Publisher and Distributor, 1989 and later.
3. Foundation Analysis & Design: Bowles, J.E., McGraw Hill (1996)
4. . J. E. Bowles, "Foundation Analysis and Design", McGraw Hill Companies, 1997.
5. M. D., Desai, "Ground Property Characterization from In-Situ Testing", Published by IGS-Surat Chapter, 2005.
6. M. J., Hvorslev, "Sub-Surface Exploration and Sampling of Soils for Civil Engineering Purposes", US Waterways Experiment Station, Vicksburg, 1949.

Reference books:

1. Soil Mechanics in Theory and Practice: Alam Singh, Asia Publisher and Distributor, 1975
2. Advanced Foundation Engineering: Murthy VNS, CBS publishing, (2007)
3. Foundation Engineering Handbook: Fang, H.Y., CBS publishing, (2004)
4. IS 1892, IS 2131, IS 4669.3, IS 1888 Codes,

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-5

Course Name: Railway Engineering

L :4 Hrs., P : Hrs., Per Week

Credits: 4

Course Outcome

1. Students should be able to explain and describe various terms in railway engineering
2. Students should be able to Explain, Discriminate and design various geometric features of railway track.
3. Students should be able to Define and describe the construction and maintenance steps of railway track.

UNIT - I

Railway track gauge, alignment of railway lines, engineering surveys construction of new lines, tracks and track stresses

UNIT - II

Rails, sleepers; ballast; subgrade and formation, rack fittings and fastenings, creep of rails, geometric design of track, curves and super-elevation

UNIT - III

Points and crossings, track junctions and simple track layouts; rail joints and welding of rails; track maintenance, track drainage

UNIT - IV

Modern methods of track maintenance, rehabilitation and renewal of track; tractive resistance and power, railway stations and yards; Railway tunnelling; signalling and interlocking; maintenance of railways and high speed trains.

Text Books

1. Railway Engineering: Saxena and Arora, Dhanpat Rai & Sons
2. Railway Engineering : Rangawala

Reference Books

1. Railway Tracks Engineering: J.S.Mundrey, Tata McGraw-Hill Publishing

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-6

Course Name: Engineering Geology

L :4 Hrs., P : Hrs., Per Week

Credits: 4

Course Objectives:

1. To Understand the Earth System
2. Teach fundamental geomorphic and dynamic processes on the Earth
3. To know about the material present i.e. minerals and rocks
4. understand Structural deformations and impacts
5. Earthquakes and causes, effects, zones
6. Know subsurface exploration methods
7. Know groundwater availability and domains; recharge
8. Teach consideration for site selection for projects.

Scope:

Geodynamics: Internal structure of the earth, Continental drift and Plate Tectonics.

Geomorphology:

Geomorphological processes and classification, weathering and erosion, landforms.

Mineralogy: Definition and classification of Minerals, Megascopic physical properties of Minerals,

Overview of silicate family minerals (Quartz, Feldspar, Olivine, Pyroxene, Amphibole, Mica).

Petrology: Rock cycle; Genesis, Textures, Forms/structures, classification and strength aspects of Igneous,

sedimentary and Metamorphic rocks. Geomechanical properties of rocks, Rock as construction aggregate

and road metal.

Structural Geology: Rock Deformation; Attitude of rocks, Mechanism of formation, nomenclature

classification and field identification of Folds, Joints, Faults. Problems on Strike, Dip, thickness and depth

of strata.

Stratigraphy: Scope & application of Stratigraphic principles, overview of Indian Stratigraphy.

Introduction to Rock Mechanics; Concept of stress and strain in rocks, rock mass classification and rating,

RQD, etc. Surface and subsurface geological investigations; Drilling, core logging, Geological,

geophysical and remote sensing investigations; Scope of rock excavation, blasting techniques, Geological

criteria for design & construction of Dams, Bridges, Tunnels, buildings.

Mass movements, Stability of Slopes & Landslides: Causes and prevention.

Engineering Seismology: Causes and effects of earthquakes; Seismic waves, magnitude, intensity, seismic

zoning & seismic Zones of India; Tsunamis.

Geohydrology: Rocks as aquifers, occurrence and availability of Groundwater; Groundwater

investigations, groundwater development and management in India; Techniques of groundwater recharge.

Course Outcomes:

1. Generate global vision of Earth processes
2. Identify the subsurface material
3. Knows reason of phenomena like Earthquakes and zoning
4. Know about groundwater availability zones and groundwater management
5. Know megascopic and mechanical properties of rocks
6. Know field procedures of subsurface exploration

7. Generate subsurface profiles and map structures
8. Know considerations for site selection for engineering projects

REFERENCE:

1. KVGK Gokhale, Principles of Engineering Geology, BS Publications.
2. F.G.Bell, Fundamentals of Engineering Geology, BS Publications, 2005.
3. Parbin Singh, Engineering Geology, S K Kataria and Sons, Sixth Edition.
4. Homes Arthur and Homles Doris, Principles of Physical Geology, ElBS Publications, 1987.
5. F.G. H. Blyth and M.H. de Freitas, A geology for Engineers, Elsevier, Seventh Edition.

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Syllabus for Semester B.Tech V

Course Code: 25ES01TH0505-7
System

Course Name: Urban Drainage and Sewage

L :4 Hrs., P : Hrs., Per Week

Credits: 4

- **C01:** Explain components and principles of urban drainage and sewerage systems. *(K2)*
 - **C02:** Analyze stormwater runoff and design drainage systems. *(K3)*
 - **C03:** Design sewer networks and appurtenances using hydraulic principles. *(K4)*
 - **C04:** Evaluate wastewater collection, conveyance, and pumping systems. *(K5)*
 - **C05:** Assess sustainable and smart urban drainage solutions. *(K5)*
-

Module-wise Syllabus

Module 1: Introduction to Urban Drainage Systems (6 Hours)

- Need and importance of urban drainage
 - Types of drainage systems: combined, separate, partially separate
 - Components of sewerage system
 - Dry weather flow (DWF) and wet weather flow (WWF)
 - Population forecasting and wastewater estimation
-

Module 2: Stormwater Drainage (8 Hours)

- Urban hydrology concepts
 - Rainfall analysis and IDF curves
 - Runoff estimation methods (Rational Method, empirical methods)
 - Time of concentration
 - Design of stormwater drains (open channels, closed conduits)
 - Urban flooding issues and mitigation
-

Module 3: Sewer Design and Hydraulics (10 Hours)

- Types of sewers and materials
 - Hydraulic design of sewers (self-cleansing velocity, minimum velocity)
 - Design of circular sewers (running partially full and full)
 - Sewer alignment and layout
 - Hydraulic equations (Manning's formula)
 - House sewer connections
-

Module 4: Sewer Appurtenances (6 Hours)

- Manholes: types, spacing, design considerations
 - Drop manholes
 - Flushing tanks
 - Inverted siphons
 - Ventilation of sewers
 - Inspection and maintenance practices
-

Module 5: Sewage Pumping and Conveyance (6 Hours)

- Need for pumping stations
 - Types of pumps used in sewerage systems
 - Pump selection and design basics
 - Rising mains design
 - Operation and maintenance of pumping stations
-

Module 6: Wastewater Collection & Treatment Interface (6 Hours)

- Sewer system interaction with treatment plants
 - Preliminary and primary treatment overview (revision linkage)
 - Combined sewer overflow (CSO)
 - Industrial wastewater in municipal systems
 - Sludge handling basics
-

Module 7: Sustainable Urban Drainage Systems (SUDS) (6 Hours)

- Concepts of Low Impact Development (LID)
- Rainwater harvesting in urban areas
- Permeable pavements

- Green roofs and bio-retention systems
 - Smart drainage and real-time monitoring
 - Case studies (Indian cities)
-

Practical / Laboratory Component (2 Hours/Week)

1. Estimation of stormwater runoff using rainfall data
 2. Design of stormwater drain using Rational Method
 3. Hydraulic design of sewer (using Manning's equation)
 4. Design of manhole and sewer appurtenances
 5. Pump selection and head calculation
 6. Field visit to sewage treatment plant / drainage system
 7. Mini-project: Design of urban drainage network for a locality
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-

Text Books

1. B.C. Punmia & Ashok Jain – *Environmental Engineering Vol. II (Wastewater Engineering)*
 2. Peavy & Row – *Environmental Engineering*
 3. Metcalf & Eddy – *Wastewater Engineering: Treatment and Resource Recovery*
-

Reference Books

1. Fair, Geyer & Okun – *Water and Wastewater Engineering*
 2. CPHEEO Manual – *Sewerage and Sewage Treatment (India)*
 3. S.K. Garg – *Environmental Engineering*
 4. IS Codes and IRC guidelines (latest editions)
-

Suggested Assignments / Projects

- Design of sewer network for a residential area
- Urban flood analysis case study
- Study of drainage system of a smart city
- Comparative study of combined vs separate sewer systems
- Rainwater harvesting plan for urban campus

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Syllabus for Semester B.Tech VI

**Course Code: 25ES01TH0601
Structures**

Course Name: Design of Steel

L :3 Hrs., P :2 Hrs., T: 1 Per Week

Credits: 3

Course Outcomes

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

1. Apply provisions of IS 800:2007 including material properties, load combinations, partial safety factors, and limit state philosophy to determine design strengths of structural steel elements.
2. Design tension members with bolted and/or welded connections.
3. Design compression members (columns/struts) considering buckling.
4. Design laterally supported and/or laterally unsupported beams.
5. Evaluate wind loads on industrial buildings using codal provisions (IS 875 Part 3) and determine design wind forces on structural elements.

Unit I

Steel as a structural material, various grades of structural steel, properties, various rolled steel sections and their properties, Introduction to IS 800:2007, 808, 816, 875 etc, Design philosophies, Plate (Local) buckling, Classification of cross-sections (flexure).

Structural Steel Fasteners: Introduction, Behavior of bolted and welded connections (types, designations, properties, permissible stresses), failure of bolted and welded joints. Strength of bolt and strength of weld, Efficiency of joints, Design of simple, bolted and welded connections.

Unit II

Design of axially loaded members (a) Tension members: Introduction, Net area, Shear-lag.

(b) Compression members: Introduction, Euler's buckling theory, Classification of cross-sections (buckling), Imperfection factor.

Analysis of roof truss of an industrial building : Introduction to different components of industrial shed, types of trusses, assessment member forces under various loads (dead load, live load and wind load).

Unit III

Design of simple beams: Introduction, Flexural behaviour of beams which does not undergo lateral buckling, Flexural behaviour of beams which undergo lateral buckling, Shear behaviour, Web buckling and Crippling, Design strength in bending, Design strength in shear, Limit state serviceability – Deflection, Introduction to plate girder.

Unit IV

Design of columns: Introduction, Design of axially loaded rolled sections, built up columns, laced and battened columns, Column base: slab base and gusseted base under axial loads.

Text Books

1. Design of steel structures by N. Subramanian (Using IS: 800-2007) Publisher: Oxford University Press, India
2. Limit State Design of Steel Structures by S. K. Duggal Publisher: Tata Mc Graw Hill
3. Limit State Design of Steel Structures : Based on IS: 800-2007 by Dr. Ramchandra, Virendra Gehlot Scientific Publishers
4. Design of steel structures by K. S. Sairam Publisher: Pearson Education

References

1. McCormac, J. C., Nelson, J.K. Jr., Structural Steel Design. 3rd edition. Prentice Hall, N.J., 2003.
2. Galambos, T.V., Lin, F.J., Johnston, B.G., Basic Steel Design with LRFD, Prentice Hall, 1996
3. Steel Design Manual by ELBS Publications
4. Salmon, C.G. and Johnson, J.E., Steel Structures: Design and Behavior, 3rd Edition, Harper & Row, Publishers, New York, 1990.

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0602

Course Name: Foundation Engineering

L : 3 Hrs., P : Hrs., Per Week

Credits: 2

Course Outcomes

On successful completion of the course students will be able to,

1. Plan the Geotechnical exploration program for major civil engineering structure.
2. Analyze the stability of slopes and solve the field problems.
3. Predict the earth pressure on the resisting structures.
4. Understand various geotechnical designs and select type of foundations.
5. Study the various techniques of ground improvement and apply them on field.

Unit I

Geotechnical Exploration

Principle methods of subsurface exploration, IS 1892, geophysical methods, open pits and shafts, types of boring, number, location and depth of boring for different structures, types of soil samples and samplers. Collection & shipments of samples, plotting of bore log and sampling record. Standard penetration test, corrections for field N- values & correlations for obtained design soil parameters, pressuremeter test.

Unit II

Lateral Earth Pressure

Earth pressure at rest, active and passive pressure, general & local states of plastic equilibrium in soil. Rankine's and Coulomb's theories of earth pressure, Effects of surcharge, submergence.. Graphical construction by Culmann for simple cases of wall- soil system for active pressure condition. Concept of reinforced earth retaining wall.

Unit III

Stability Of Slopes

Causes and types of slope failure, stability analysis of infinite slopes and finite slopes, center of critical slip circle, slices method and friction circle. Slopes with pore pressure consideration. Taylor's stability numbers & stability charts, method of improving stability of slopes, types, selection and design of graded filter, concept of soilnailing.

Unit IV

Shallow Foundation

Different types of shallow foundation and modes of failure. Bearing capacity of soil By Terzaghi's theory, Design criteria and codal provisions. Effect of water table on bearing capacity, correction factor for shape and depth of footing. Bearing capacity estimation on sand and clays from N-value, factor affecting bearing capacity. Settlement of shallow foundation: elastic and consolidation settlement, differential settlement, control of excessive settlement. Proportioning the footing for equal settlement. Plate load test: Procedure, interpretation for bearing capacity and settlement prediction, limitations, IS code method.

Unit V

Pile Foundations

Classification of piles, constructional features of cast-in-situ & pre-cast concrete piles. Pile driving methods. Load transfer mechanism of axially loaded piles. Pile capacity by static formula & dynamic formulae. Pile load test and interpretation of data, group action in piles, spacing of piles, negative skin friction and its effect on pile capacity, general feature of under reamed piles. Settlement of pile group, Introduction to IS2911.

Unit VI

Ground Improvement

Introduction to different methods of ground improvement.

Text Book

1. Basic and Applied soil Mechanics by Gopal Ranjan & A.S. Rao, New Edge Int. Ltd. (2004)
2. Foundation analysis and design by Bowles J. E., McGraw Hill International publishing (1995)

3. Soil Mechanics in Theory and Practice by Alam Singh, Asia Publisher and Dist. (1975 & later).
4. Geotechnical Engineering : A practical problem solving approach by Sivakugan N., Das B. M., Cengage Learning, 2011

Reference

1. Advanced Foundation Engineering: V. N. S. Murthy, CBS Publications (2007)
2. Principles of Foundation Engineering: B. M. Das, Cengage Publications (2011)
3. Foundation Engineering Manual : By N. V. Nayak
4. NPTEL Course
5. IS codes

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0603
channels

Course Name: Flow through pipes &

L :2 Hrs., P : 2 Hrs., Per Week Credits: 4

Course Outcomes

The students would be able to :

1. Understand and describe various principles of flow through pipes, open channel and centrifugal pumps.
2. Apply basic principles of flow in pipes and open channel to solve fluid flow problems in steady state condition.
3. Analyse and design various components of fluid flow system and comparison of possible solutions.
4. Compare and interpret the data / information/concepts/principle and used for solving incompressible fluid flow problems in steady state condition.

Unit I : Flow through Pipes

Hydraulically smooth and rough pipe; frictional resistance to flow; Darcy-Weisbach & Hazen- William equation, moody's diagram. Hydraulic gradient line and Total energy gradient line.

Unit II :

Pipes in series and parallel, branched pipe Water hammer pressure, three reservoir problem, flow through siphon; Concept of drag lift and its simple application.

Unit III : Flow through Open Channel

General : Introduction to open channel flow; Types of channel , Geometrical properties, Types of flow in open channel, Chezy's equation; Manning's equation; determination of discharge; normal depth; most economical channel section.

Unit IV

Uniform Flow : Basics.- continuity, energy and momentum equations, Characteristics of uniform flow, computations of uniform flow.

Non uniform flow (Critical Flow) : Basics and computations; Applications of specific energy concept, specific energy curve, gradual transition of channels, humps, width restrictions.

UNIT V

Gradually Varied Flow (GVF): Introduction to GVF; Equation of gradually varied flow; analysis of GVF: Classification and characteristics of surface profiles; Computations of water surface profile using direct step method.

Rapidly Varied Flow (RVF):, theory and classification of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular channel. Length, height and application of hydraulic jump. Energy dissipation.

UNIT VI

Dimensional analysis: Definition and use, fundamentals and derived dimensions, methods, application of methods to develop relationship in variables. Dimensionless numbers and its significance

Theory of model : Similitude, geometric, kinematic and dynamic similarities, Reynolds and Froude number law its significance.

Text Books

1. Hydraulics and fluid mechanics including Hydraulic machines by Dr. P. N. Modi and S. M. Seth, Latest edition, Standard book house (2002).
2. Theory and application of fluid mechanics by K Subramanya ,Tata McGraw Hill Publishing Company Ltd New Delhi.
3. A textbook of Fluid Mechanics & Hydraulic Machines by R. K. Bansal.

Reference

1. Fluid Mechanics & Hydraulic Machines by S. C. Gupta, Darling Kindersley (I) pvt. Ltd. Pearson licensee, Nodia, UP.
2. Fluid Mechanics – Fundamentals and applications by Yunus cengel, Jhon M Cimbala, Tata McGraw Hill Publishing Company Ltd New Delhi, latest edition/ reprint.
3. Open Channel Hydraulics by V. T. Chow.

Course Code: 25ES01PR0603

Course Name: Flow through pipes & channels lab

Course Outcomes

The students would be able to,

1. Describe the process of experimentation. Handle and operate the equipments according to its working principle.
2. Plan and conduct the experiments in accordance with the objectives.
3. Determine important parameters, coefficients of equipments and interpret the experimental observations.
4. Analyze and compare the experimental and theoretical / analytical observations.

List of Practical's

Minimum 8 of the following

1. Determination of Manning's constant for open channel.
2. Determination of Chezy's constant for open channel.
3. Developing specific energy diagram for a rectangular channel.
4. Study of GVF profiles.
5. Determination of spillway constant.
6. Analysis of branch network using software like water GEMS, EPANET for pipe flow
7. Analysis of rectangular / trapezoidal section.
8. Three reservoir problem
9. Determination of height of hump for critical flow. (transition of channel)
10. Determination of friction factor in flow through GI pipe
11. Any other experimental employing self learning and other tools.

Note: Use of python in all or any relevant practical is desirable.

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-1 Course Name: Advanced Construction Techniques

L : 3 Hrs., P : 2 Hrs., Per Week Credits: 4

Course Objectives

1. To share overview of latest concrete construction methods.
2. To make the students understandable of various methods of handling and placing of concrete.
3. To make the students familiar with the construction techniques in marine environment.
4. To make students aware about the quality and safety measures in construction works.

Course Curriculum

Concrete Construction Methods, Formwork Design and Scaffolding; Slip Forms and other moving forms; Pumping of Concrete; Grouting and Mass Concreting Operations (roller compacted concrete); Ready-Mix Concrete; Various Methods of Handling and Placing Concrete, Accelerated curing, Hot and cold weather concreting, Under water concreting, Prestressing. Steel and Composite Construction Methods, Fabrication and erection of structures including heavy structures, Prefab construction, Industrialized construction and Modular coordination. Special Construction Methods, Construction in Marine Environments, High Rise Construction, Bridge Construction including Segmental Construction, Incremental Construction and Push Launching Techniques; Geosynthetics; Safety, Quality Measures and Reliability

Course outcomes

1. To get overview of latest concrete construction methods.
2. An understanding of various methods of handling and placing of concrete.
3. Understand the construction techniques in marine environment.
4. To make aware the quality and safety measures in construction works.

Text and Reference Books:

1. Neville A M and Brooks J J, "Concrete Technology" Pearson Education Asia, Singapore, 1994.
2. Neville A M, "Properties of Concrete" Pearson Education, New Delhi, 2004.
3. Peurifoy R L, "Construction Planning, Equipment and Methods" McGraw Hill Ltd., New York, 2002.

Course Code: 25ES01PR0604-1

Course Name: Advanced Construction Techniques Lab

Assignments (minimum 8) based on above said syllabus & case studies on **Advanced Construction Techniques**

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-2 Course Name: Industrial Waste Water Treatment

L : 3 Hrs., P : 2 Hrs., Per Week Credits: 4

Course Outcomes

The students would be able to;

1. Describe and explain the necessity and importance of industrial wastewater treatment along with the basic principles and fundamentals of waste minimization for reuse recycling and recovery, treatment processes and disposal methods in industrial wastewater.
2. Apply the knowledge of various principles, theories and equations in process analysis and in the design of various treatment methodologies for various industrial waste waters.

Syllabus

Unit -I

Necessity and importance of industrial waste water treatment, Generation of Industrial wastewater, characteristics of industrial waste water and its variation, sampling and analysis of wastewater, statistical analysis of data, standards for wastewater disposal, Environmental impacts due to discharge of wastewater on streams, land and sewerage system.

Unit-II

Basic concept of Reuse, Recycling and Resource recovery; Volume and strength reduction; Construction, working, design parameters and design of Equalization, and Neutralization and floatation.

Unit-III

Treatment flow sheet of wastewater from various industries viz. Pulp and paper, tanning, Sugar, Dairy, Cement, Fertilizers, Metal Finishing, textile, Etc. Joint treatment of industrial waste.

Unit-IV

Types of biological processes used in treatment of wastewater. Construction, working and design parameters of Stabilization pond, aerated lagoon, oxidation ditch, biological denitrification processes, membrane biological reactors. Anaerobic treatment of industrial wastewater.

Unit- V

Industrial waste survey; Stream sanitation, stream sampling, Stream survey; Principles and techniques for Industrial pollution prevention and control.

Text Books

1. Nemerow N. L. Theories and Practices of Industrial Waste Treatment, Addison Wesley Publishing Co. NY. 2nd Edition.
2. W.W. Eckenfelder, Industrial Water Pollution Control Mc-Graw Hill Book Co. 2nd Edition.
3. Freeman H.M., Industrial Pollution Prevention Handbook Mc-Graw Hill 1st Edition.
4. E.B. Bess Elivievre, Treatment of Industrial Waste, Mc-Graw Hill Book Co. 1st Edition.
5. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal And Reuse, 3rd Edition Mc- Graw Hill 1991.
6. A. D. Patwardhan, Industrial waste water treatment, PHI Learning Pvt. Ltd, EEE, 2nd Edition. June 2017

Reference Books

1. Central Pollution Control Board, India, Comprehensive Industry Document Series.
2. Gupta KR, Environmental Legislation of India, Atlantic publishers, 2006.
3. CPHEEO Manual on Sewerage & sewage treatment.

Course Name: Industrial Waste Water Treatment Lab Course Code: 25ES01PR0604-2

Assignments (minimum 8) based on above said syllabus & case studies on **Industrial waste water treatment**

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-3 Course Name: Retrofitting & Rehabilitation of Civil Infrastructure

L : 3 Hrs., P : 2 Hrs., Per Week

Credits: 4

Course Outcomes

Student shall be able to

1. visualize and elaborate the root causes of damage and deterioration of structures
2. identify, suggest and explain damage assessment method based on condition of structure
3. aware of different available repairing materials and their specific application
4. aware of different available repairing techniques and case studied

Unit1

Strength and Durability of structures 10

- a. Inspection, identification and diagnosis of common defects and failure with possible cause in buildings and infrastructural utilities
- b. Holistic Models of deterioration in RCC
- c. Corrosion in RCC: Type of corrosion, causes of corrosion of embedded reinforcement in concrete, effect of reinforcement, corrosion on concrete. Oxidation process between two metals in contact and its preventive maintenance.
- d. Permeability in concrete

Unit2

Damage Assessment methods 10

- a. Concept of structural auditing
- b. Condition Survey

c. Non Destructive testing of Structures (UPV, Rebound hammer, Half cell potentiometer, RCPT,Covermeter,Coretesting,etc.)

d. Performance evaluation

Unit3

Repairing materials 10

a. Grouts, FRP wrapping materials, Micro concrete, Adhesives and sealants, Corrosion inhibitors,Specialtypesofconcretesetc.

Unit4

TechniquesforRepairandProtectionMethods 10

a. Shoring,Underpinning,Jacketing,FRPapplication,Grouting,Guniting,Case studies

References

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials,Maintenance and

Repair",LongmanScientificandTechnicalUK,1991.

2. Shetty M.S.,"Concrete Technology -Theory and Practice", S.Chand and Company, 2008

3. HandBookonrepairandrehabilitationofRCCbuilding,CPWD,GOI,NewDelhi

4.Ravishankar.K., Krishnamoorthy.T.S, " Structural Health Monitoring, Repair andRehabilitationofConcreteStructures",AlliedPublishers,2004.

5. Dov Kominetzky.M.S., "Design and Construction Failures, TMH

Course Name: Retrofitting & Rehabilitation of Civil Infrastructure Lab

Course Code: 25ES01PR0604-3

Assignments (minimum 8) based on above said syllabus & case studies on **retrofitting& rehabilitation of civil infrastructure**

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-4 Course Name: Ground Improvement

L : 3 Hrs., P :2 Hrs., Per Week Credits: 4

Course Outcomes

On successful completion of the course students will be able to,

1. Identify problematic soils and their associated issues.
2. Understand the various ground improvement techniques.
3. Propose suitable remedial techniques and their design.

Introduction to ground improvement techniques : Concepts and essential requirements of ground improvement, classification of ground improvement techniques, economic considerations and suitability.

Compaction and Consolidation : Equipments and control of field compaction, surface compaction and deep compaction, vibrofloatation. Preloading and static loads and by vacuum, accelerated consolidation by sand drains, free strain and equal strain cases, design of sand drain layout.

Stabilization : Methods of stabilization, mechanical stabilization, organic and inorganic stabilizing agents and their characteristics - lime, cement, lime, flyash, bitumen and chemicals.

Grouting : Materials and methods of grouting, grout volume and grouting pressure, grout requirements and tests, grouting of rock foundation of dams.

Reinforced earth and Geotextiles : Basic theory of reinforced earth, materials, method, application and design of reinforced earth, characteristics of reinforced earth masses; geotextiles, geogrids and geosynthetics, their basic features, functions and applications.

Stone columns : Application, layout feature, procedures of installation, vibrofloat and rammed stone column, unit cell concept, load transfer mechanism, settlement in stone column, methods of improving the effectiveness of stone column, Design for stone column layout for intended requirements.

Text Book

1. Ground Improvement Techniques : P. P. Raj, Prentice Hall of India (2005)
2. Engineering Principles of Ground Modification : M.R. Housmann, McGraw Hill (1990)
3. Principles of Foundation Engineering: Braja M. Das, Cengage Learning Publications (2011)

References

1. Constructional and Geotechnical Methods in Foundation Engineering : R.M. Koerner, McGraw Hill (1985)
2. Design and Construction of Stone Column: FHWA Report No. Rd 83/026, (1983)
3. Advanced Foundation Engineering: V. N. S. Murthy, CBS Publications (2007)
4. NPTEL Course on Ground Improvement
5. Foundation Engineering Manual : Nayak N. V., Dhanpat Rai Publications (2009)

Course Code:25ES01PR0604-4

Course Name: Ground Improvement Lab

Outcomes:

1. Student will have an ability to suggest suitable ground improvement techniques.
2. Student will have an ability to design and layout of propose techniques.

The term work shall consist of analysis and design for any THREE of the following design assignments to be carried out by each student individually (with different data).

1. Design of sand layout in soft compressible clay deposit for required (accelerated) rate of consolidation.
2. Design of a reinforced earth retaining wall.
3. Design of stone column layout (using conventional incremented fill material or cemented granular fill material) for intended degree of improvement in safe load carrying capacity of soft soil ground.
4. Analysis and design of skirted stone columns.

The work shall be submitted in the form of a journal and shall be assessed by concerned teacher/s through viva-voice examination

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-5 Course Name: Traffic Engineering and Management

L : 3 Hrs., P :2 Hrs., Per Week Credits: 4

Course Outcomes

1. Students should be able to Define and describe various traffic studies and traffic characteristics
2. Students should be able to describe terms related to highway capacity and have knowledge of statistical tools in traffic engineering
3. Students should be able to explain various theories related to traffic flow

UNIT - I

Traffic Studies and Forecast

Traffic Studies, Traffic Characteristics, General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection; Design Hourly Volume For Varying Demand, Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, demand functions. Determination of design hourly volume; critical hour concept

UNIT - II

Highway Capacity

Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections. Problems in Mixed Traffic flow; Case studies;

UNIT - III

Accident Analysis

Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions

UNIT - IV

Traffic Flow

Theory : Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications; Probabilistic Aspects Of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications; Simulation: Fundamental principle, application of simulation techniques in traffic engineering - formulation of simulation models, Case studies. Formulation of system models.

Text Books

1. Highway Engineering: (1991) Khanna S.K. and Justo C.E.G., Nem Chand & Bros.
2. Traffic engineering and transportation planning: (1987) L.R. Kadiyali, Khanna Publications

Reference Books

1. Transport planning and Traffic Engineering, edition Latest, C A O'Flaherty, Butterworth Heinemann Publications.
2. Introduction to Transportation Engineering, edition Latest, James H Bank, Tata McGraw Hill Publications.
3. Transportation Engineering an Introduction, edition C. Jotin Khisty, PHI Publication.

**Course Code:25ES01PR0604-5
Management Lab**

Course Name: Traffic Engineering and

Course Outcomes

On completion of the course, the students will be able to;

1. Carry various traffic studies like speed studies, volume studies and parking studies etc.
2. Design traffic signals and intersections.
3. Carry out road safety audit.

Practicals

1. Speed studies
2. OD studies
3. Design of traffic signals
4. Design of intersection
5. Design of Rotaries
6. Road safety studies
7. Traffic volume studies
8. Parking studies

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-6 Course Name: Computer Aided Design and Drafting (CADD)

L : 3 Hrs., P : 2 Hrs., Per Week

Credits: 4

Course Outcomes

1. An ability to understand and apply basic fundamentals of CAD in civil engineering
2. An ability to develop computer model of various components used in civil engineering
3. An ability to develop computer program for analysis and design of various components of civil engineering structures.

Content

Fundamentals of CAD : Computer graphics & its terminology. CAD definition, concept & need. CAD process. Functional areas of CAD. Coordinate systems. Geometric transformation- concept and types. 2 dimensional (2D) geometric transformation- translation, scaling, rotation and mirror with numeric examples.

Analysis of building components through computer programs/excel

Designing of building components through computer programs/excel

Generating computer drawing from design output

Introduction to software's for modelling and design various civil engineering structures.

Text Books

1. . Ibrahim Zied, CAD / CAM: Theory and Practice, McGraw-Hill
2. Hearn E J and Baker M P, Computer Graphics, Pearson.

Course Code: 25ES01PR0604-6
Drafting Lab

Course Name: Computer Aided Design and

Course Outcomes

An ability to use various computer software's for modelling of various components used in civil engineering.

An ability to use various computer software's for analysis and design various components used in civil engineering.

An ability to develop computer program for analysis and design of various components used in civil engineering.

CE-CAD is a one-credit course that will introduce students to the basics of Computer Aided Design utilizing software to produce engineering designs. The course will also provide an overview of the different disciplines in Civil Engineering including structural, geotechnical, water resources, environmental, transportation, etc.

Content

Modelling using AutoCAD or Context Capture

Analysis and design of various structural components using STAAD/SAP Development of computer program for analysis and design of structural components.

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0604-7 Course Name: Water Transmission & Distribution System.

L : 3 Hrs., P : 2 Hrs., Per Week

Credits: 4

- **C01:** Explain components and functioning of water transmission systems.
 - **C02:** Apply hydraulic principles to design pipelines and pumping systems.
 - **C03:** Analyze water distribution networks using appropriate methods.
 - **C04:** Design and evaluate water supply systems for communities.
 - **C05:** Apply standards, operational strategies, and sustainability concepts in water distribution.
-

Syllabus Content

Unit I: Introduction to Water Transmission Systems (6 Hours)

- Overview of water supply schemes
 - Components: source, intake, treatment, transmission, distribution
 - Types of transmission systems:
 - Gravity system
 - Pumping system
 - Combined system
 - Design considerations and challenges
-

Unit II: Hydraulic Design of Transmission Pipelines (8 Hours)

- Flow through pipes: major and minor losses
- Head loss equations: Darcy–Weisbach, Hazen–Williams
- Selection of pipe diameter and material
- Economic design of pipelines
- Surge analysis (introductory) and water hammer

- Pipe appurtenances: valves, air valves, surge tanks
-

Unit III: Pumping Systems and Transmission Structures (8 Hours)

- Types of pumps (centrifugal, submersible)
 - Pump selection and characteristics
 - Pumping stations: layout and components
 - Rising mains and force mains design
 - Storage reservoirs: balancing and service reservoirs
-

Unit IV: Water Distribution Systems (8 Hours)

- Objectives and requirements of distribution systems
 - Types of distribution networks:
 - Dead-end system
 - Grid iron system
 - Ring system
 - Radial system
 - Methods of distribution: continuous vs intermittent supply
 - Design period and population forecasting
-

Unit V: Analysis of Pipe Networks (6 Hours)

- Hydraulic analysis methods:
 - Hardy Cross method
 - Equivalent pipe method
 - Introduction to looped network analysis
 - Pressure and flow distribution
 - Detection of deficiencies in networks
-

Unit VI: Operation, Maintenance, and Smart Water Systems (6 Hours)

- Leakage detection and control
 - Pipe maintenance and rehabilitation
 - Non-revenue water (NRW) management
 - Introduction to SCADA systems
 - Smart water distribution and IoT applications
 - Sustainable practices in water supply
-

Unit VII: Standards, Codes, and Design Guidelines (4 Hours)

- Overview of **Bureau of Indian Standards (BIS)** codes
 - CPHEEO Manual on Water Supply
 - Design standards for urban and rural water supply
 - Fire demand and emergency provisions
-

Text Books

1. B.C. Punmia – *Water Supply Engineering*
 2. S.K. Garg – *Water Supply Engineering*
 3. Peavy & Row – *Environmental Engineering*
-

Reference Books

1. CPHEEO – *Manual on Water Supply and Treatment*
2. AWWA – *Water Distribution Systems Handbook*
3. Steel & McGhee – *Water Supply and Sewerage*
4. Relevant BIS Codes

Course Name: Water Transmission & Distribution System Lab

Course Code: 25ES01PR0604-7

Assignments (minimum 8) based on above said syllabus & case studies on **Water Transmission & Distribution System**.

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0605-1

Course Name: Urban Infrastructure

L :3 Hrs., P : Hrs., Per Week

Credits: 3

Course Objectives

- To understand the planning, design, and management of urban infrastructure systems
 - To integrate transportation knowledge with broader urban services
 - To develop sustainable, resilient, and smart infrastructure solutions
 - To analyze challenges in rapidly growing urban areas
-

Course Outcomes (COs)

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

- **CO1:** Explain components and planning principles of urban infrastructure systems
 - **CO2:** Analyze urban transportation integration with other infrastructure systems
 - **CO3:** Evaluate water supply, sewerage, and drainage systems in urban areas
 - **CO4:** Assess solid waste management and environmental sustainability practices
 - **CO5:** Apply smart city concepts and infrastructure resilience strategies
-

Module 1: Introduction to Urban Infrastructure

- Definition and scope of urban infrastructure
 - Components: Transportation, water supply, sewerage, drainage, solid waste, energy
 - Urbanization trends in India
 - Institutional framework and governance (ULBs, development authorities)
 - Urban infrastructure challenges in developing countries
-

Module 2: Urban Planning and Infrastructure Integration

- Principles of urban planning

- Land use planning and zoning
 - Master plans and development plans
 - Integration of transportation systems with urban infrastructure
 - Transit-Oriented Development (TOD)
 - Urban mobility and multimodal systems
-

Module 3: Urban Water Supply Systems

- Water demand forecasting
 - Sources of water supply
 - Urban water distribution systems
 - Design principles of pipelines and storage systems
 - Non-revenue water and leakage control
 - Introduction to SCADA systems in water supply
-

Module 4: Urban Sewerage and Drainage

- Sewerage systems: Types and design principles
 - Stormwater drainage systems
 - Urban flooding and mitigation measures
 - Combined vs separate sewer systems
 - Wastewater treatment and reuse
 - Low Impact Development (LID) and Sustainable Urban Drainage Systems (SUDS)
-

Module 5: Solid Waste Management

- Types and characteristics of municipal solid waste
 - Collection, segregation, transportation, and disposal
 - Recycling and resource recovery
 - Composting, biomethanation, and waste-to-energy
 - Rules and regulations (Solid Waste Management Rules, India)
-

Module 6: Smart and Sustainable Urban Infrastructure

- Smart city concepts and components
- ICT applications in urban infrastructure
- Green infrastructure and climate-resilient design
- Energy-efficient infrastructure systems
- Urban heat island effect and mitigation
- Case studies of smart cities (India and global)

Teaching Methods

- Lectures with case studies
- GIS-based demonstrations (basic exposure)
- Field visits to municipal infrastructure facilities
- Assignments on urban infrastructure planning

Assessment Scheme (Typical NBA Pattern)

- Continuous Internal Evaluation (CIE): 30 marks
- End Semester Examination (ESE): 70 marks

Text Books

1. *Urban and Regional Planning* – Peter Hall
2. *Urban Infrastructure: Planning, Management and Operations* – K. K. Chitkara
3. *Water Supply Engineering* – B.C. Punmia
4. *Environmental Engineering* – Peavy & Row

Reference Books

1. *Urban Transportation Planning* – Michael Meyer & Eric Miller
2. *Municipal Solid Waste Management* – George Tchobanoglous
3. *Sustainable Urban Infrastructure* – S. Lehmann
4. MoHUA Manuals on Urban Infrastructure (Government of India)

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0605-2

Course Name: Solid Waste Management

L :3 Hrs., P : Hrs., Per Week

Credits: 3

Course Outcomes

The students would be able to;

1. Explain and describe various sources, characteristics, processing methods and disposal methods of solid waste.
2. Identify and explain necessity of solid waste management, its components and various rules and legislation.

Unit-I

Introduction to solid waste management: necessity, functional elements of solid waste management, Organization structure, Impact of solid waste on environment, MSW rules 2016, Construction and demolition (C&D) waste management rule 2016, Swachh Bharat mission, PPP model.

Unit-II

Characteristics of solid wastes : Classification, sources, composition, quantity, Factors affecting the quantity and per capita contribution of solid waste. Physical and chemical characteristics, sampling and analysis of solid waste.

Unit-III

Segregation, Collection and transportation of solid waste : Segregation methods, methods of collection, equipment's used for collection and transportation of solid waste. Transfer stations and its economic use. Estimation of truck capacity, vehicles routing

Unit-IV

Solid waste processing : Methods of processing like Salvaging, pyrolysis, RDF, biogas recovery, choice of methods and merits and demerits of various processing methods.

Unit-V

Solid waste management : Composting, Principles, methods of composting, factors affecting composting. Design of composting pit, vermi composting.

Sanitary land filling : Site requirement, methods, leachate management. Solid waste mining, design of landfills, bio-gas, bio-mining, fire hazards.

Incineration : Principles, types, merits and demerits.

Text Books

1. Bhide A.D. and Sundaresan B.B. Solid wastemanagement in developing countries by (INSDOC,New Delhi)
2. Sasikumar K. and Gopi Krishna S. Solid waste management, PHI learning pvt ltd, Delhi
3. Bhatia H. S. Environmental Pollution and Control, Galgotia publication, Delhi

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

**Course Code: 25ES01TH0605-3
Structure**

Course Name: Prestressed Concrete

L :3 Hrs., P : Hrs., Per Week

Credits: 3

Course Outcomes

1. The graduates will be able to apply the fundamental concepts of prestressing, prestressing systems employed in practice. Losses of Prestress.
2. The graduates will be able to apply limit state design criteria to assess the limit state of collapse and serviceability, ensuring structural safety and functionality under various loading conditions.
3. The graduates will be able to analyse and design structural sections for flexure, bending, shear and bond, integrating principles of prestressed concrete.
4. The graduates will be able to design statically indeterminate prestressed structures.
5. The graduates will be able to design prestressed concrete pipes and slabs.

Introduction to Prestressed Concrete:

Analysis of Prestress and Losses of Prestress

Analysis of prestressed concrete sections for flexure considering loading stages, computational of sectional properties, critical sections under working loads for pretensioned and post tensioned members, load balancing method of analysis of prestressed concrete beams, losses in prestress

Design for Flexure and Shear:

Design for flexure and shear– Flexural analysis of beams for limit state of serviceability,

design for simply supported beams for limit state of collapse – shear and diagonal tension in un-cracked beams, diagonal cracking in shear, shear design for limit state of collapse.

Design of End Anchorages:

End zone stresses in prestressed concrete members, pretension transfer bond, transmission length, end block of post tensioned members.

Statically Indeterminate Structures:

Analysis and design - continuous beams - Concept of linear transformation - concordant cable profile and cap cables.

Prestressed Concrete Slabs and Pipes:

Design of simply supported post tensioned slabs, Prestressed Concrete Pipes.

References:

1. Krishna Raju.N, "Prestressed Concrete", 4th Edition, Tata McGraw Hill Publishing
Co. New Delhi 2006.

2. Sinha. N. C., & Roy. S. K., "Fundamentals of Prestressed Concrete", S.Chand& Co.,
1985.

3. Rajagopalan .N, "Prestressed Concrete", International, Limited, 2005. 2th Edition,
Alpha Science

4. Lin .T.Y, "Design of Prestressed Concrete Structures", John Wiley and Sons - Inc
1981.

5. Leonhardt .F. "Prestressed Concrete Design and Construction", - Second Edition
Wilhelm Ernst & Sohn, Berlin, 1964.

6. Guyon .V, "Limit State Design of Prestressed Concrete", - Vol - 1 & 2, Applied

Science Publishers, London **1995**.

7. Dayaratnam.P, "Prestressed Concrete", Tata McGraw Hill Publishing Co. New Delhi

2000.

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Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0605-4 Course Name: Advanced Geotechnical Engineering

L : 3 Hrs., P : Hrs., Per Week

Credits: 3

Course Outcomes

On successful completion of the course students would be able to;

1. Understand the various properties of the soils and their determination.
2. Do the settlement analysis in different conditions and design the foundations.
3. Analyse the modern approach for investigations of soil properties.

Syllabus

- General Concepts: Soil Structure, Consistency of Cohesive Soils, plasticity, Clay Activity, Atterberg Limits, USCS and AASHTO Soil Classification.
- Stresses in Soils: Geostatic and External Stresses in Soils, Pore Water Pressure Concept, Boussinesq and Westergaard Relationships for External Stress. Calculations, Effect of Ground Water Table.
- Shear Strength of Soils: Stress Path, Mohr Circle, Mohr-Coulomb Failure Criteria, Shear Strength in the Laboratory (Direct Shear Test, Triaxial Compression Test, CU, UU and CD tests), Skempton's Pore Water Pressure Parameters, Shear Strength in the Field (Vane Shear, CPT, SPT, PMT, CBR)
- Settlement Analysis of Soils: Consolidation Theory, Immediate Settlement in Granular Soils, Primary consolidation, Secondary Compression, Time Rate of Settlement, Methods for Accelerating Consolidation Settlements, Pre-compression.
- Design of Foundations: Introduction, general principles, strip and pad foundations, building on shrinkable soil, building on fill, raft foundation – variable soil and make up ground, pile foundation – choice, types; construction problems.

- Introduction to Unsaturated Soil Mechanics: Types of problems, typical profiles of unsaturated, tropical and residual soil, expansive and collapsing type of soils. Origin and formation, identification and classification of expansive and collapsing soils, Contractile skin.
- Collapse and Heave: Collapse potential and swell potential, importance and their determination by different laboratory methods, Heave prediction based on Oedometer tests, suction tests and empirical procedures, heave and collapse settlement.
- Technical Forensic Investigation: Collection of data, problem characterization, development of failure hypotheses, a realistic backanalysis, field observations and performance monitoring, modelling of failure hypothesis and quality control of formal and technical aspects of the work. Numerical Problems.

Text Book

1. Das, B. M. (2008). Advanced Soil Mechanics. Taylor and Francis Group, London, Second edition.
2. Murthy, V.N.S. (2002). Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering. CRC Publications
3. Coduto, D. P. (1999). Geotechnical Engineering: Principles and Practices, Prentice Hall
4. Gopal Ranjan, Rao A.S.R. (2007). Basic and Applied Soil Mechanics Foundation Engineering, New Age Publications
5. Som N. N. & Das S.C. (2002): Theory & practice of foundation Design, Prentice Hall Edn, Asia

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Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0605-5 Course Name: Pavement Design

L : 3 Hrs., P : Hrs., Per Week

Credits: 3

Course Outcomes

1. The student can understand, analyze, apply and evaluate various parameters required in the design of flexible and rigid pavement of highway and airfield pavements.
2. They can analyze, apply and evaluate the analysis of flexible and rigid of highway and airfield pavements.
3. They can analyze, apply and evaluate the design of flexible and rigid of highway and airfield pavements.
4. They will be able to conduct field tests and can analyze, apply and evaluate the design strengthening of pavements.

Unit I

General: Types and component parts of pavements, Factors affecting design and performance of pavements.

Design parameters: Design wheel load, Standard axle load and wheel assemblies for road vehicles. Under carriage system of aircraft. Tyre and contact pressure, contact area, imprints, computation of ESWL for flexible and rigid pavements. ESWL of multiple wheels, repeated loads and EWL factors. Pavement behaviour under transient traffic loads. airport traffic areas, Serviceability concept.

Unit II

Analysis of flexible pavement : Stress, strain, deflection analysis one layer system by Boussinesq's. Burmister's two layer theory, three layer and multi-layer theories; wheel load stresses, Layer equivalent concepts, Stress and deflections for rigid pavements due to load and temperature, influence charts

Analysis of Rigid pavement : Wheel load stresses, warping stresses, frictional stresses, combined stresses.

Unit III

Highway Flexible pavement design : Empirical, semi-empirical and theoretical approaches, Triaxial (Kansas state method), Design using the latest IRC code, AASHTO method of design.

Unit IV

Highway Rigid pavement design: Design of CC pavement for roads and runways as per IRC latest code, design of joint details for longitudinal joints, contraction joints and expansion joints, PCA and AASHTO methods

Unit V

Airfield flexible pavement design : Mcleod (Canadian method), FAA, US Corps of engineering, CBR.

Airfield rigid pavement design : Definitions of ACN, PCN, LCN, Calculation of LCN value, Ultimate load analysis and yield lines patterns method, FAA, PCA & LCN methods.

Unit VI

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Pavement testing and evaluation : Pavement Failures in both Flexible Pavement & Rigid Pavement - types and causes, condition surveys and surface evaluation for unevenness, rut depth, profilometers, bump integrators, falling weight deflectometer.

Failures of pavements : Causes and remedies, maintenance and rehabilitation of pavements. **Strengthening of pavements** : Benkleman beam deflection study.

Text Books

1. Pavement Design by Srinivasa Kumar, R, Orient Black Swan, 2013.
2. Pavement Evaluation and Maintenance Management System by Srinivasa Kumar, R, Universities Press (India) Private Limited
3. Pavement Analysis and Design by Yang H. Huang 2nd Edition, Pearson Education, Inc., Pearson Prentice Hall Company.

4. Airport Engineering by G Venkatappa Rao, Tata McGraw -Hill Publishing Company Ltd.
5. IRC-37: (Latest Code) Guide lines for Design of Flexible Pavement
6. IRC-58: (Latest code) Guide lines for Design of Plain Jointed Rigid Pavement for highways

References

1. Principles of Pavement Design by H.J.Yoder and Witczak, John wiley and sons.
2. Pavement Engineering: Principles and Practice, Third Edition Book by Rajib Basu Mallick and Tahar El-Korchi Publisher: CRC press, Taylor and Francis
3. Airport Engineering by Khanna and Arora, Nemchand & Brothers.
4. Highway Engineering by Khanna O.P, Justo C.G., Nem Chand Publishers
5. MOST Specifications for Road and Bridge Works, 1994 (Third Revision)
6. NPTEL Course on Pavement Design

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Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0605-6 Course Name: Infrastructure Planning and Management

L : 3 Hrs., P : Hrs., Per Week

Credits: 3

- **C01:** Explain infrastructure systems, planning processes, and policy frameworks
 - **C02:** Apply demand forecasting and economic analysis techniques for infrastructure projects
 - **C03:** Evaluate infrastructure projects using financial and economic appraisal methods
 - **C04:** Analyze management strategies including PPP models and contract systems
 - **C05:** Assess sustainability, risk, and lifecycle performance of infrastructure systems
-

Module 1: Introduction to Infrastructure Systems

- Definition and classification of infrastructure (physical, social, economic)
 - Role of infrastructure in economic development
 - Infrastructure sectors: transportation, water supply, energy, communication
 - Infrastructure scenario in India
 - Institutional and regulatory framework (Central, State, Urban Local Bodies)
-

Module 2: Infrastructure Planning Process

- Infrastructure planning cycle
 - Demand assessment and forecasting techniques
 - Data collection and analysis
 - System approach to infrastructure planning
 - Regional and urban infrastructure planning
 - Land use–transport interaction
-

Module 3: Economic and Financial Analysis

- Time value of money
 - Cost-benefit analysis (CBA)
 - Cost-effectiveness analysis
 - Life Cycle Costing (LCC)
 - Internal Rate of Return (IRR), Net Present Value (NPV), Benefit-Cost Ratio (BCR)
 - Sensitivity and risk analysis
-

Module 4: Infrastructure Project Management

- Project identification and formulation
 - Detailed Project Report (DPR) preparation
 - Project scheduling techniques (CPM, PERT)
 - Resource planning and allocation
 - Construction management basics
 - Monitoring and evaluation of infrastructure projects
-

Module 5: Public Private Partnership (PPP)

- Need and evolution of PPP
 - Types of PPP models (BOT, BOOT, DBFO, HAM, etc.)
 - Risk allocation in PPP projects
 - Contract management and concession agreements
 - Case studies of PPP projects in India
-

Module 6: Sustainable Infrastructure and Asset Management

- Concept of sustainable infrastructure
 - Environmental and social impact assessment (EIA & SIA)
 - Climate-resilient infrastructure planning
 - Infrastructure asset management systems
 - Maintenance strategies and performance evaluation
 - Smart infrastructure and digital tools (IoT, GIS, BIM basics)
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Teaching-Learning Methods

- Lectures and case studies
 - Software exposure (basic scheduling tools / spreadsheets)
 - Field visits (infrastructure projects, municipal bodies)
 - Guest lectures from industry experts
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Assessment Scheme (NBA Pattern)

- Continuous Internal Evaluation (CIE): 30 marks
 - Assignments / Case Study: 10
 - Mid-Term Test: 20
 - End Semester Examination (ESE): 70 marks
-

Text Books

1. K. K. Chitkara – *Construction Project Management*
 2. S. K. Sharma – *Construction Management and Accounts*
 3. Ashwini Kumar & B. K. Sahoo – *Infrastructure Planning and Management*
-

Reference Books

1. Infrastructure Planning Handbook
2. Principles of Infrastructure Development
3. Project Management: A Systems Approach
4. Ministry of Housing and Urban Affairs manuals and reports
5. World Bank infrastructure guidelines

Ramdeobaba University, Nagpur

Department of Civil Engineering

Syllabus for Semester B.Tech VI

Course Code: 25ES01TH0605-7 Course Name: Introduction to Piping and Plumbing Engineering

L : 3 Hrs., P : Hrs., Per Week

Credits: 3

Course Outcomes (COs)

After completion of the course, students will be able to:

- **CO1:** Understand the basic principles of piping and plumbing systems.
 - **CO2:** Identify different types of pipes, fittings, and plumbing materials.
 - **CO3:** Analyze water supply and drainage requirements in buildings.
 - **CO4:** Prepare basic plumbing layouts for residential and small commercial buildings.
 - **CO5:** Apply relevant codes and sustainable practices in plumbing design.
-

Syllabus Content

Unit I: Introduction to Plumbing Engineering (6 Hours)

- Definition and scope of plumbing engineering
 - Importance in civil infrastructure and public health
 - Components of plumbing systems
 - Types of plumbing systems:
 - Water supply system
 - Sanitary drainage system
 - Stormwater drainage
 - Plumbing terminology and symbols
-

Unit II: Pipes, Materials, and Fittings (8 Hours)

- Types of pipes:
 - Metallic: GI, steel, copper
 - Non-metallic: PVC, CPVC, HDPE, PEX
- Properties, advantages, and limitations

- Pipe fittings, valves, and joints
 - Selection criteria for piping materials
 - Corrosion and protection methods
-

Unit III: Water Supply Systems in Buildings (8 Hours)

- Sources of water supply
 - Water demand estimation
 - Storage systems: overhead tanks, underground tanks
 - Distribution systems:
 - Direct supply system
 - Indirect supply system
 - Pipe sizing basics (continuity and flow principles)
 - Pumps and pumping systems (introductory)
-

Unit IV: Sanitary Plumbing and Drainage (8 Hours)

- Types of wastewater: greywater, blackwater
 - Traps: types and functions (P-trap, S-trap, bottle trap)
 - Ventilation systems in plumbing
 - House drainage system layout
 - Sewer connections and inspection chambers
 - Principles of gradient and flow in drainage
-

Unit V: Plumbing Fixtures and Installation (6 Hours)

- Common plumbing fixtures:
 - Toilets, wash basins, sinks, urinals, showers
 - Fixture materials and standards
 - Installation practices and guidelines
 - Leak detection and maintenance
 - Testing of plumbing systems
-

Unit VI: Codes, Standards, and Sustainable Plumbing (6 Hours)

- Overview of plumbing codes (Indian and international)
- Introduction to **Bureau of Indian Standards (BIS)** guidelines
- Water conservation techniques:
 - Rainwater harvesting integration

- Low-flow fixtures
 - Greywater reuse systems
 - Introduction to green building concepts in plumbing
-

Text Books

1. Rangwala, S.C. – *Water Supply and Sanitary Engineering*
 2. S.K. Garg – *Water Supply Engineering*
 3. Charanjit Shah – *Plumbing Engineering*
-

Reference Books

1. B.C. Punmia – *Water Supply Engineering*
 2. National Building Code (NBC), India
 3. ASPE Plumbing Engineering Design Handbook
 4. BIS Codes related to water supply and sanitation
-

Practical/Assignment Suggestions

- Preparation of plumbing layout for a residential building
- Estimation of water demand for a small apartment
- Identification and cataloging of plumbing fixtures
- Case study of plumbing system in a commercial building

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Syllabus for Semester B.Tech VI

Course Code: 25ES01PR0606 Course Name: Technical Drawing Analysis & Evaluation

L : 3 Hrs., P : Hrs., Per Week Credits: 3

- **C01:** Interpret various types of engineering drawings used in construction projects.
 - **C02:** Analyze architectural and structural drawings for dimensional and functional accuracy.
 - **C03:** Evaluate service drawings (plumbing, electrical, HVAC) for coordination.
 - **C04:** Identify errors, omissions, and conflicts in drawings.
 - **C05:** Apply relevant codes and standards to assess drawing quality and compliance.
-

Syllabus Content

Unit I: Fundamentals of Technical Drawing Interpretation (6 Hours)

- Types of construction drawings:
 - Architectural, structural, service drawings
 - Drawing scales, units, and dimensioning systems
 - Symbols, legends, and notations
 - Reading title blocks and revision history
 - Introduction to drawing standards and conventions
-

Unit II: Architectural Drawing Analysis (8 Hours)

- Detailed study of:
 - Site plan, floor plans, elevations, sections
- Functional analysis of space planning
- Circulation and accessibility evaluation
- Identification of inconsistencies in architectural drawings

- Case-based analysis of residential and commercial buildings
-

Unit III: Structural Drawing Evaluation (8 Hours)

- Structural components in drawings:
 - Footings, columns, beams, slabs
 - Reinforcement detailing basics (RCC drawings)
 - Bar bending schedule (BBS) interpretation
 - Checking structural drawings with architectural plans
 - Identification of design and detailing discrepancies
-

Unit IV: Services Drawing Coordination (8 Hours)

- Plumbing drawings: water supply and drainage layouts
 - Electrical drawings: wiring, lighting, and power layouts
 - HVAC basics in building drawings
 - Clash detection between services and structure
 - Coordination between different disciplines
-

Unit V: Drawing Errors, Quality Checks & Evaluation (6 Hours)

- Types of drawing errors:
 - Dimensional errors
 - Missing details
 - Inconsistencies between drawings
 - Checklist for drawing approval
 - Constructability review concepts
 - Industry practices in drawing validation
-

Unit VI: Codes, Standards, and Industry Practices (6 Hours)

- Overview of **Bureau of Indian Standards (BIS)** and **National Building Code of India (NBC)**
 - Introduction to drawing approval process in projects
 - Quality assurance in construction documentation
 - Exposure to digital tools (AutoCAD, BIM-based checking)
 - Introduction to shop drawings and as-built drawings
-

Tutorial / Practical Component (Suggested)

(Essential for skill development)

1. Interpretation of a complete set of residential building drawings
2. Cross-checking architectural and structural drawings
3. Identification of errors in given drawing sheets
4. Preparation of drawing review checklist
5. Basic clash detection exercise using CAD/BIM
6. Case study: Real project drawing evaluation

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Syllabus for Semester B.Tech VI

Course Code: 25ES01PR0608 Course Name: Quality Control in Construction Processes

L : Hrs., P : 2 Hrs., Per Week Credits: 1

Course Objectives:

1. To introduce the students about quality and safety related challenges in construction industry
2. To make students aware about the globally recognized guidelines/theories for quality and safety in construction
3. To make students self efficient to audit quality and safety related challenges in construction

Total quality management concepts; ISO9000; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment; Material Quality Assurance; Specifications and Tolerances.

Safety issues; Injury accidents and their causes; Safety program components; Role of workers, Supervisors, Managers and Owners; Safety Procedures for various construction operations; Safety audits; Safety laws. Safety Organization and Management: Safety policies, safety organization, safety committees, safety representatives, outside agencies – Govt. intervention, international agreements.

REFERENCE:

1. Levitt, R.E. and Samelson, N.M., Construction Safety Management, Mc. Graw Hill Book Company, Inc., N.Y. 1991.

2. Juran Frank, J.M. and Gryna, F.M., Quality Planning and Analysis Tata McGraw Hill 1982.
3. Raymond Elliot Levitt & Nancy Morse Samelson Construction Safety Management Amazon
Second edition.
4. Grant E.L. and Leavensworth Statistical quality Control McGraw Hill 1984.
5. Hutchins G, ISO 9000, Visa Books, New Delhi, 1993.
6. Ron Baden Hellard, Total Quality in Construction Projects, Thomas Telford, London

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Syllabus for Semester B.Tech VI

Course Code: 25ES01PR0609

Course Name: Simulation in Civil Engineering

L : Hrs., P :2 Hrs., Per Week

Credits: 1

Course Objective:

Student shall be able

- a. To prepare Capital Budgeting of a Construction project in excel sheet.
- b. To use time value of money formulae such as IRR, CRF, PV,FV in the excel sheet.
- c. To prepare a Construction programme for Town ship, Road Project, Bridge project etc with using Prima Vera Softwares./staad pro software

Spreadsheet applications for calculation of Present worth, future worth, IRR, CRF etc.

Project management software such as Prima vera software, Microsoft project- Preparation of project and feed data into the software for various projects. Study of Statistical Software such as SPSS