KLE Technological University
Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Academic year 2023-2027
School of Civil Engineering
Program: Civil Engineering

KLE Technological University | Creating Value, Leveraging Knowledge

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Vision and Mission of KLE Technological University

Vision

KLE Technological University will be a national leader in Higher Education–recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavors.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.

- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.

- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

Vision and Mission Statements of the School / Department

Vision

To be the most preferred branch of engineering through the highest order of excellence in teaching-learning and research with social commitment and responsibility.

Mission

- To create an outstanding learning experience through rigorous curriculum of theory and practice that develops students' technical and professional skills to succeed in a wide range of careers.
- To Continually advance research through a culture of discovery, creativity, and innovation to benefit the humankind
- To serve as highly capable resources to society, the profession through professional organizations, consultancy and continuing education.

Program Educational Objectives/Program Outcomes and Program-Specific Objectives

Program Educational Objectives -PEO's
Conceive, realize and design civil engineering infrastructure that is the backbone of growth and prosperity of mankind.
Plan, construct and maintain the built environment meeting the demands of humanity.
Assess the impact of civil engineering activities on economy, environment and society at large.
Work in team with moral, ethical and professional responsibilities.
Cultivate the aptitude for continuous learning and learn to adapt to the changing needs of the society.
Program Outcomes-PO's
Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).
The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)
Program Specific Objectives -PSO's
Innovative Materials and Construction Technologies: Graduates will demonstrate the ability to evaluate, select, and apply innovative construction materials and modern technologies to improve the performance, durability, and sustainability of civil infrastructure.
Digitalization and Smart Construction: Graduates will demonstrate the ability to apply digital and computational tools such as CAD, BIM, GIS, and project management software for planning, design, monitoring, and management of civil infrastructure.
Resilient Systems and Disaster Risk Reduction: Graduates will demonstrate the ability to design, assess, and manage civil infrastructure for resilience against natural hazards, climate change, and urbanization challenges.

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Curriculum Structure-Overall

Semester								Total Program Credits: 177
Course with course code	I	II	III	IV	V	VI	VII	VIII
	Single variable calculus (5-0-0)	Multivariable calculus (5-0-0)	Laplace Transform and Statistics (4-0-0)	Numerical methods and Partial differential equations (4-0-0)	Structural Analysis-II (3-0-0)	Design of Steel Structures (4-0-0)	Pre-Stressed Concrete (3-0-0)	Program Elective - 6 (3-0-0) / Internship Training (0-0-6)
	Engineering Physics (3-0-0)	Engineering Chemistry (3-0-0)	Building Technology and Services (3-0-0)	Structural Analysis-I (4-0-0)	Geotechnical Engineering (3-0-0)	Estimation and Costing (4-0-0)	Program Elective -2 (3-0-0)	Open Elective – 1 (3-0-0)
	Basic Electrical and Electronics Engineering (4-0-0)	Engineering Mechanics (4-0-0)	Surveying (4-0-0)	Water And Wastewater Engineering (4-0-0)	Design of RCC Structures (4-0-0)	**Program Elective -1:** (3-0-0)	Program Elective -3 (3-0-0)	Capstone Project / Internship Project (0-0-11)
	Applied physics lab (0-0-1)	Problem Solving With Data Structures (0-0-3)	Mechanics of Fluids (4-0-0)	Concrete Technology (3-0-0)	Transportation Engineering (4-0-0)	PA &LR (3-0-0)	Program Elective -4 (3-0-0)	
	Basic Mechanical Engg (3-0-0)	Computer Aided Engineering Drawing (0-0-3)	Mechanics of Materials (4-0-0)	Construction Project Management (3-0-0)	Construction Economics & Management (3-0-0)	Industry Readiness and Leadership Skills (0.5-0-0)	Program Elective -5 (3-0-0)	
	Engineering Exploration (0-0-3)	Design Thinking For Social Innovation (0-1-1)	Survey Practice – I (0-0-1)	Hydrology & Irrigation Engineering (3-0-0)	Arithmetical Thinking and Analytical Reasoning (0.5-0-0)	Geotechnical Engineering laboratory (0-0-1)	CIPE / EVS (Audit)	
	C programming for problem solving (0-0-3)	Professional Communication (1-1-0)	Building Engineering Drawing (0-0-1)	Survey Practice – II (0-0-1)	Highway Engg. Laboratory (0-0-1)	CEM Laboratory (0-0-1)	Senior Design Project (0-0-6)	
			Corporate Communication (0.5-0-0)	Problem Solving and Analysis (0.5-0-0)	Environmental Engg. Laboratory (0-0-1)	Design Studio - Steel and RC Structures (0-0-1)	Construction Site Management Workshop (0-0-1)	
			Material Testing Laboratory (0-0-1)	Gen AI for Civil Engineering (0-0-1)	Computer Aided Design Laboratory (0-0-1)	Minor Project (0-0-6)		
				Concrete Laboratory (0-0-1)	Mini Project (0-0-3)			
Credits	22	22	22.5	24.5	23.5	23.5	22	17

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Curriculum Structure-Semester wise

Semester - I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	18EMAB101	Single variable calculus	BS	(4-1-0)	5	6	50	50	100	3 hrs
2.	22EPHB102	Engineering Physics	BS	(3-0-0)	3	3	50	50	100	3 hrs
3.	21EEXF101	Basic Electrical and Electronics Engineering	ES	(4-0-0)	4	4	50	50	100	3 hrs
4.	22EMEF101	Basic Mechanical Engg	ES	(3-0-0)	3	3	50	50	100	3 hrs
5.	22ECRP101	Engineering Exploration	ES	(0-0-3)	3	6	80	20	100	3 hrs
6.	18ECSP101	C programming for problem solving	ES	(0-0-3)	3	6	80	20	100	3 hrs
7.	21EPHP102	Applied Physics Lab	BS	(0-0-1)	1	2	80	20	100	3 hrs
TOTAL				15-1-6	22					

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Semester - II

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	18EMAB102	Multivariable calculus	BS	(4-1-0)	5	6	50	50	100	3 hrs
2.	23ECHB101	Engineering Chemistry	BS	(3-0-0)	3	3	50	50	100	3 hrs
3.	15ECVF102	Engineering Mechanics	ES	(4-0-0)	4	4	50	50	100	3 hrs
4.	18ECSP102	Problem Solving with Data Structures	ES	(0-0-3)	3	3	50	50	100	3 hrs
5.	15EMEP101	Computer Aided Engineering Drawing	ES	(0-0-3)	3	3	80	20	100	3 hrs
6.	20EHSP101	Design Thinking for Social Innovation	HS	(0-1-1)	2	4	80	20	100	3 hrs
7.	15EHSH101	Professional Communication	HS	(0-0-2)	2	2	80	20	100	3 hrs
TOTAL				15-1-6	22					

Semester- III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	20EMAB202	Laplace Transform and Statistics	PC	(4-0-0)	4	4	50	50	100	3 hrs
2.	15ECVC201	Building Technology and Services	PC	(3-0-0)	3	3	50	50	100	3 hrs
3.	15ECVC202	Surveying	PC	(4-0-0)	4	4	50	50	100	3 hrs
4.	15ECVF201	Mechanics of Fluids	ES	(4-0-0)	4	4	50	50	100	3 hrs
5.	15ECVF202	Mechanics of Materials	ES	(4-0-0)	4	4	50	50	100	3 hrs
6.	17ECVP201	Survey Practice – I	PC	(0-0-1)	1	2	80	20	100	3 hrs
7.	21ECVP201	Material Testing Lab	PC	(0-0-1)	1	2	80	20	100	3 hrs
8.	24ECVP201	Building Engineering Drawing	PC	(0-0-1)	1	2	80	20	100	3 hrs
9.	22EHSH201	Corporate Communication	HS	(0.5-0-0)	0.5	2	100	-	100	-
TOTAL				19.5-0-3	22.5					

Semester- IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	20EMAB207	Numerical methods and Partial differential equations	BS	(4-0-0)	4	4	50	50	100	3 hrs

2.	24ECVC202	Structural Analysis-I	PC	(3-0-0)	3	4	50	50	100	3 hrs
3.	23ECVC201	Water and Wastewater Engineering	PC	(4-0-0)	4	4	50	50	100	3 hrs
4.	24ECVC201	Concrete Technology	PC	(3-0-0)	3	3	50	50	100	3 hrs
5.	20ECVC206	Construction Project Management	PC	(3-0-0)	3	3	50	50	100	3 hrs
6.	15ECVC207	Hydrology & Irrigation Engineering	PC	(3-0-0)	3	3	50	50	100	3 hrs
7.	22EHSH202	Problem Solving and Analysis	HS	(0.5-0-0)	0.5	2	100	-	100	-
8.	15ECVP204	Survey Practice – II	PC	(0-0-1)	1	2	80	20	100	3 hrs
9.	21ECVP202	Concrete Laboratory	PC	(0-0-1)	1	2	80	20	100	3 hrs
10.	24ECVP202	Generative AI for Civil Engineering	PC	(0-0-2)	2	4	80	20	100	3 hrs
TOTAL				21.5-0-4	24.5					

Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	21ECVC301	Structural Analysis-II	PC	(3-0-0)	3	3	50	50	100	3 hrs

2.	24ECVC301	Geotechnical Engineering	PC	(3-0-0)	3	3	50	50	100	3 hrs
3.	15ECVC303	Design of RCC Structures	PC	(4-0-0)	4	4	50	50	100	3 hrs
4.	15ECVC304	Transportation Engineering	PC	(4-0-0)	4	4	50	50	100	3 hrs
5.	19ECVC305	Construction Economics & Management	PC	(3-0-0)	3	3	50	50	100	3 hrs
6.	22EHSH301	Arithmetical Thinking and Analytical Reasoning	HS	(0.5-0-0)	0.5	2	100	-	100	-
7.	15ECVP301	Highway Engineering Laboratory	PC	(0-0-1)	1	2	80	20	100	3 hrs
8.	15ECVP302	Environmental Engineering Laboratory	PC	(0-0-1)	1	2	80	20	100	3 hrs
9.	15ECVP305	Computer Aided Design Lab	PC	(0-0-1)	1	2	80	20	100	3 hrs
10.	15ECVW301	Mini Project	PW	(0-0-3)	3	6	50	50	100	3 hrs
TOTAL				17.5-0-6	23.5					

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	25ECVC301	Design of Steel Structures	PC	(4-0-0)	4	4	50	50	100	3 hrs
2.	25ECVC302	Estimation and Costing	PC	(4-0-0)	4	4	50	50	100	3 hrs

3.	-	Program Elective -1	PE	(3-0-0)	3	3	50	50	100	3 hrs
4.	16EHSC301	PA & LR	HS	(3-0-0)	3	3	50	50	100	3 hrs
5.	22EHSH302	Industry Readiness and Leadership Skills	HS	(0.5-0-0)	0.5	2	100	-		-
6.	15ECVP304	Geotechnical Engineering laboratory	PC	(0-0-1)	1	2	80	20	100	3 hrs
7.	20ECVP301	CEM Laboratory	PC	(0-0-1)	1	2	80	20	100	3 hrs
8.	23ECVP301	Design Studio - Steel and RC Structures	PC	(0-0-1)	1	2	80	20	100	3 hrs
9.	15ECVW302	Minor Project	PW	(0-0-6)	6	12	50	50	100	3 hrs
TOTAL				12.5-0-9	23.5					

Semester- VI

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	24ECVC401	Pre-Stressed Concrete	PC	(3-0-0)	3	3	50	50	100	3 hrs

2.	-	Program Elective -2	PE	(3-0-0)	3	3	50	50	100	3 hrs
3.	-	Program Elective -3	PE	(3-0-0)	3	3	50	50	100	3 hrs
4.	-	Program Elective -4	PE	(3-0-0)	3	3	50	50	100	3 hrs
5.	-	Program Elective -5	PE	(3-0-0)	3	3	50	50	100	3 hrs
6.	24ECVP401	Construction Management Workshop	PC	(0-0-1)	1	3	80	20	100	3 hrs
7.	15EHSA401	CIPE / EVS (Audit)	HS	-	-	2	-	-	-	-
8.	19ECVW401	Senior Design Project	PW	(0-0-6)	6	6	50	50	100	3 hrs
TOTAL				15-0-7	22					

Semester- VII

Semester- VIII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	-	Program Elective - 6	PE	(3-0-0)	3	3	50	50	100	3 hrs

2.	-	Open Elective – 1	OE	(3-0-0)	3	3	50	50	100	3 hrs
3.	18ECVI491	Internship Training	PC	(0-0-6)	6	6	50	50	100	3 hrs
4.	18ECVW403	Capstone Project / Internship Project	PW	(0-0-11)	11	11	50	50	100	3 hrs
TOTAL				6-0-11/ 0-0-17	17					

Semester	I	II	III	IV	V	VI	VII	VIII	**Total**
Credits	22	22	22.5	24.5	23.5	23.5	22	17	177

List of Open Electives

Sr.No	Name of the Course	Course Code
1.	Nano Composite Materials	15ECVO401
2.	Optimization Techniques	15ECVO402

List of Program Electives

Sr.No	Name of the Course	Course Code
1.	Traffic Engineering	15ECVE302
2.	Pavement Engineering	15ECVE303
3.	Applied Hydrology and Hydraulic Structures	18ECVE301
4.	Introduction to structural dynamics and earthquake engineering	24ECVE301
5.	Advanced Geotechnical Engineering	23ECVE301
6.	Design of Sub-structures	15ECVE401
7.	Advanced RCC	15ECVE402
8.	FEM Analysis	15ECVE403
9.	Construction Methods	18ECVE401
10.	Advanced Project Management	19ECVE401
11.	Construction Contract Management.	23ECVE401
12.	Solid Waste Management	15ECVE407
13.	Air Pollution	15ECVE409
14.	Advanced Waste Water Treatment	15ECVE408

Curriculum Content- Course wise

Program: BE Civil Engineering		**Semester: I**
Course Title: Single Variable Calculus		**Course Code:18EMAB101**
L-T-P: 4-0-1	**Credits: 05**	**Contact Hours:50**
ISA Marks:50	**ESA Marks:50**	**Total Marks:100**
Teaching Hours:06	**Examination Duration: 3Hrs**	

Unit I

1. Functions, Graphs and Models **7hrs**

Functions, types of functions, transformations and models (Linear, exponential, trigonometric).
MATLAB: Graphing functions, Domain-Range and Interpreting the models

2. Calculus of functions and models **13hrs**

Limit of a function, Infinite limits- graph, Continuity and discontinuity, Intermediate value theorem statement, Roots of the equation using Bisection Method and Newton- Raphson Method
Interpretation of derivative as a rate of change, All the rules of derivatives (List only), Maxima, Minima and optimization problems. Curvature and Radius of Curvature, Indeterminate forms, L- Hospital's rule-Examples
MATLAB: optimization problems. Curvature problems

Unit II

3. Infinite Series **06 hrs**

Definition, Convergence of series, Tests of convergence – p-series, Alternating series. Power series, radius of convergence, Taylor's and Maclaurin's series, Applications of Taylor's and Maclaurin's series
MATLAB: Convergence of series

4. Integral calculus **14 hrs**

Tracing of standard curves in Cartesian form ,Parametric form and Polar form; Beta and gamma function, relation between them, evaluation of integrals using Beta and gamma functions; Applications to find arc length, Area, Volume and surface area (Cartesian, parametric and polar curves). Approximate integration- Trapezoidal rule, Simpson's 1/3 rule
MATLAB: problems on arc length, area, volume and surface area

Unit III

5. Ordinary differential equations of first order **10 hrs**

(a) Introduction to Initial Value problems. Linear and Bernoulli's equations, Exact equations and reducible to exact form, Numerical solution to Initial Value problems-Euler's method, Modified Euler's method and Runge-Kutta method
(b) Applications of first order differential equations-Orthogonal trajectories growth and decay problems, mixture problems, Electrical circuits, falling bodies.
MATLAB: Solve differential equations

Text Books

1. Early Transcendentals Calculus- James Stewart, Thomson Books, 7ed 2010.

Reference Books:

1. Calculus Single and Multivariable, Hughues-Hallett Gleason, Wiley India Ed, 4ed, 2009.
2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010

Program: BE Civil Engineering		Semester: I
Course Title: Engineering Physics		Course Code:22EPHB102
L-T-P: 3-0-0	Credits: 03	Contact Hours:03 Hrs./Week
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:40	Examination Duration: 3Hrs	

Unit I

1. Concept of Motion - Kinematics in One Dimension **6hrs**

Introduction, Motion Diagrams, The Particle Model, Position Model, Linear Velocity and Acceleration, Uniform Motion, Instantaneous Velocity, Finding Position from Velocity, Motion with Constant Acceleration, Free Fall Motion on an Inclined Plan, Instantaneous Acceleration, Numericals.

2. Kinematics in Two Dimensions **6hrs**

Introduction to Vectors, Properties of vectors, Coordinate Systems and Vector Components, Vector Algebra. Position, velocity and Acceleration vectors, Projectile Motion, Relative Motion, Uniform Circular Motion, Velocity and Acceleration in Uniform Circular Motion, Nonuniform Circular Motion and Angular Acceleration, Numericals.

3. Force and Motion **4hrs**

Concept of Force, Identifying Forces, A Virtual Experiment, Newton's First Law, Newton's Second Law, Free-Body Diagrams, Applications.

Unit II

4. Dynamics I **5hrs**

Equilibrium using Newton's second Law, Friction, Drag, Newton's Third Law, Analyzing Interacting Objects, Newton's Third Law, Applications.

5. Dynamics II **6 hrs**

Motion in a plane, Dynamics in Two Dimension, Velocity and Acceleration in Uniform Circular Motion, Dynamics of Uniform Circular Motion, Fictitious Forces, Non-uniform Circular Motion, Numerical.

6. Impulse and Momentum **5hrs**

Momentum and Impulse, Problems, Conservation of Momentum, Inelastic Collisions, Explosion, Momentum in Two Dimension, Numericals.

Unit III

7. Energy and Work **8hrs**

Energy: Kinetic Energy and Gravitational Potential Energy, Restoring Forces, Hooke's Law, Elastic Potential Energy, Elastic Collisions, Energy Diagrams,

Work: Work and Kinetic Energy, Force, Work and Potential energy, Conservation of Energy, Power, Numericals.

Text Books

1.John W Jewett and Raymond A Serway, Physics for SISAntists and Engineers with modern physics,, Cengage publication, India Edition, 8th Edition.

Reference Books:

1.Randall D Knight, Physics for SISAntists and Engineers, Pearson publication, 2ndEdition.

2.Hans C Ohanian and John T Markert, Physics for Engineers and SISAntists, W W Norton and Company, Volume 1, 3rd Edition

Program: BE Civil Engineering		Semester: I
Course Title: Basic Mechanical Engineering		Course Code:22EMEF101
L-T-P: 3-0-0	Credits: 03	Contact Hours:4 hrs /week
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:40	Examination Duration: 3Hrs	

Unit I

1. Introduction to Mechanical Engineering. **3hrs**

Definition of engineering, Mechanical Engineering, Branches of Mechanical Engineering, Who are Mechanical Engineers?, Mechanical Engineers' top ten achievements.

2. Manufacturing Engineering: Basics of Manufacturing **13 hrs**

What is manufacturing?, The main manufacturing sectors, The importance of the main manufacturing sectors to the Indian economy, Scales of production
Classification of manufacturing Processes.
Advances in Manufacturing: CNC machines, Mechatronics and applications

Unit II

3. Design Engineering: Power Transmission Elements **11 hrs**

Overview
Design Application:

• Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems.
• Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical Problems.
• Ball and Roller Bearings, Types, Applications.

4. Thermal Engineering 1: Prime Movers. **05 hrs**

Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Problems on Engine Performance, Future trends in IC engines.

Unit III

5. Thermal Engineering 2: Thermal Systems' Applications **06 hrs**

Refrigeration system, Air conditioning system, Pumps, Blowers and Compressors, Turbines, and their working principle and specifications.

Text Books

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Third Edition, 2013- Cengage Learning.4
2. K.R.Gopalkrishna, SudhirGopalkrishna, S.C. Sharma. A Text Book of Elements of Mechanical Engineering, 30th Edition, Oct 2010,–Subhash Publishers, Bangalore.

Reference Books:

1. Course Material developed by the Department of Mechanical Engineering.
2. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy, The Elements of Workshop Technology - Vol I & II , 11th edition 2001, Media Promoters and Publishers.
3. Basic Manufacturing, Roger Timings, Third edition, Newnes, An imprint of Elsevier

Program: BE Civil Engineering		Semester: I
Course Title: Basic Electrical and Electronics Engineering		Course Code:21EEXF101
L-T-P: 4-0-0	Credits: 04	Contact Hours:6 hrs /week
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:50	Examination Duration: 3Hrs	

Unit I

1. Introduction to Electrical & Electronics Technology **2 Hrs**

Electrical Power Generation (convention and renewable energy sources, with PV elaborated), transmission, distribution, utilization (Electric Vehicle as a case study), Electrical and Electronic Systems, concept and power of abstraction, lumped circuit abstraction, and its limitation.

2. The Circuit Abstraction **10 Hrs**

Energy storage and dissipating elements (RLC), Ideal and practical sources, series and parallel circuits, concept of order of the system, voltage dividers, RC, RL, RLC with KCL and KVL, Mesh and Nodal analysis with an example.

3. Introduction to Transformer and Electric Drive **10 Hrs**

Electromagnetic principles, classification of electric machines – static and rotary, transformers, motors, PMDC, stepper, BLDC, single and three-phase induction motors, selection of motors for various applications. Safety measures.

Unit II

4. Semiconductor Devices and its Applications **10 Hrs**

Fundamentals of semiconductors, PN junction diode, BJT, FET, Thyristors, Integrated circuits, Linear application – Transistors and Operational amplifiers, oscillators (Op-Amp based), Nonlinear application – Power electronics converters.

5. Digital Abstraction **10 Hrs**

Concept of digital abstraction, Number systems, base conversion – binary, decimal, hexadecimal, BCD, Gray code, Boolean algebra, logic gates, combinational circuits, - half adders, full adders, half subtractor and full subtractor using k-maps for 2 or 3 variables, sequential circuits – registers, counters.

6. Mechatronic Subsystem **8 Hrs**

Power supply, Introduction to sensors and actuators, signal conditioning and interfacing, Control logic design for mechatronic applications.

Text Books

1. Anant Agarwal and Jefferey H. Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann -Elsevier, 2005
2. Hughes, Electrical and Electronic Technology, 12th Edition, Pearson, 2016.

Reference Books:

1. N.P.Mahalik, Mechatronics - Principles, Concepts and Applications, Tata McGraw-Hill, 2011
2. K.A Krishnamurthy and M.R.Raghuveer, Electrical, Electronics and Computer Engineering for Scientist and Engineers, 2, New Age International Publishers, Wiley Eastern, 2001
3. George Kennedy, Electronic Communication Systems, 4, Tata McGraw Hill, 2000
4. Morris Mano, Digital Logic and Computer Design, 21st Indian print Prentice Hall India, 2000

5. Boylestead Nashelsky, Electronic devices & Circuit theory, 6, Prentice Hall India, 2000
6. David A Bell, Electronic Devices and Circuits, PHI New Delhi, 2004
7. Ramakant Gayakwad, Operational Amplifiers & applications, 3, PHI, 2000
8. W.Bolton, Mechatronics - Electronic Control Systems in Mechanical and Electrical Engineering, 3, Pearson Education, 2005
9. Ernest O Doeblin, Dhanesh N Manik, Measurement Systems, 6th Edition, McGraw Hill Education; 2017

Program: BE Civil Engineering		Semester: I
Course Title: Engineering Exploration		Course Code:22ECRP101
L-T-P: 0-0-3	Credits: 03	Contact Hours:6 hrs per week
ISA Marks:80	ESA Marks:20	Total Marks:100
Teaching Hours:78	Examination Duration: 3Hrs	

Unit I

1. Introduction to Engineering and Engineering Study
2. Role of Analysis in Engineering, Analysis Methodology
3. Data Analysis Graphing
4. Basics of Engineering Design, Multidisciplinary Nature of Engineering Design
5. Project Management
6. Sustainability in Engineering
7. Ethics
8. Modeling, Simulation and Data Acquisition using Software Tool
9. Platform based development : Arduino
10. Course Project

Reference Books:

1. Engineering Fundamentals & Problem Solving by Arvid Eide, Roland Jenison, Larry Northup, Steven, Mc GrawHill Higher Education, 6th Edition (2011)
2. Engineering Exploration (Edited Book, 2008) by Pearson Publication

Program: BE Civil Engineering		Semester: I
Course Title: C Programming for Problem Solving		Course Code:18ECSP101
L-T-P: 0-0-3	Credits: 03	Contact Hours:6 hrs per week
ISA Marks:80	ESA Marks:20	Total Marks:100
Teaching Hours:78	Examination Duration: 3Hrs	

Unit I

1. Introduction to Problem solving

Introduction to algorithms / flowcharts and its notations, top down design, elementary problems

2. Basics of C programming language

Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements.

3. Decision control statements

Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements: break, continue.
Introduction to Debugging Skills
Introduction to Test Driven Programming.

4. Iterative statements

while, do while, for, nested statements

5. Functions

Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros.
Introduction to Coding Standards

6. Arrays and Strings

Introduction, Declaration, Accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays,
Introduction to Code Optimization and refactoring

7. Pointers

Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function.

8. Structures and Unions

Introduction, passing structures to functions, Array of structures, Unions

Text Books

1. R.G.Dromey, How to Solve it by Computer, 1ed, PHI, 2008.
2. Yashvant Kanetkar, Let us C ,15th ed, BPS Publication, 2016.

Reference Books:

1. B W Kernighan, D M Ritchie, The Programming language C, 2ed, PHI, 2004.

2. B S Gottfried, Programming with C, 2ed, TMH, 2006.
3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.

Program: BE Civil Engineering		Semester: I
Course Title: Engineering Physics lab		Course Code:21EPHP102
L-T-P: 0-0-1	Credits: 01	Contact Hours:02 Hrs./Week
ISA Marks:80	ESA Marks:20	Total Marks:100
Teaching Hours:50	Examination Duration: 3Hrs	

Unit I

1. Experimental Data Error Analysis
2. Coefficient of Friction
3. Centripetal Force
4. Young's Modulus by Searle's method
5. The Law of Forces by three wire suspension table
6. Force Table and Vector addition of forces
7. Moment of inertia and rotational motion
8. Projectile motion
9. Variable g pendulum

10 Study of one dimension motion by linear air track

Program: BE Civil Engineering		Semester: II
Course Title: Multivariable calculus		Course Code:18EMAB102
L-T-P: 4-0-1	Credits: 05	Contact Hours:50
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:50	Examination Duration: 3Hrs	

Unit I

1.Partial differentiation **12 hrs**

Function of several variables, Partial derivatives, Level curves, Chain rule, Errors and Approximations. Extreme value problems. Lagrange's multipliers.

2.Double integrals **08 hrs**

Double integrals- Rectangular and polar coordinates, Change the order of integration. Change of variables, Jacobian. Application of double integrals

MATLAB: optimization problems, application of double integrals

Unit II

3. Triple integrals **07 hrs**

Triple integrals, Cartesian, change to Cylindrical and Spherical coordinates Application of Triple integrals

4. Calculus of Vector Fields **13 hrs**

Vector fields, Gradient and directional derivatives. Line and Surface integrals. Independence of path and potential functions. Green's theorem, Divergence of vector field, Divergence theorem, Curl of vector field. Stokes theorem.

MATLAB: application of Triple integrals, Vector calculus problems

Unit III

5. Differential equations of higher orders **(5+5) hrs**

(a) Linear differential equations of second and higher order with constant coeffiISAnts The method of Variation of parameters. Initial and boundary value problems.
(b) Applications of second order differential equations-Newton's 2nd law, electrical circuits, Simple Harmonic motion. Series solution of differential equations. Validity of Series solution of Differential equations.

MATLAB: application of differential equations

Text Books

1.Early Transcendental Calculus- James Stewart, Thomson Books, 7ed 2010

Reference Books:

1.Calculus Single and Multivariable, Hughues-Hallett Gleason, Wiley India Ed, 4ed, 2009.
2.Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010

Program: BE Civil Engineering		**Semester: II**
Course Title: Engineering Mechanics		**Course Code:15ECVF102**
L-T-P: 4-0-0	**Credits: 04**	**Contact Hours:04 Hrs./Week**
ISA Marks:50	**ESA Marks:50**	**Total Marks:100**
Teaching Hours:50	**Examination Duration: 3Hrs**	

Unit I

1. Overview of Civil Engineering **4hrs**

Evolution of Civil Engineering Specialization, scope and role.
Impact of Civil Engineering on National economy, environment and social & cultural fabric. Challenges and Opportunities for Civil Engineers Civil Engineering Marvels, Future challenges, Higher education and Research.

2. Coplanar concurrent force system **12hrs**

Introduction to Engineering Mechanics: Basic idealizations – Particle, Continuum, Body, Rigid body, Deformable body, Definition of force and its elements; Laws of Mechanics – Parallelogram law of forces, Principle of transmissibility, Law of Superposition, Newton's laws of motion. Classification of force systems, Resultant of coplanar concurrent force system: Definitions – Resultant, composition & Resolution of a force, Equilibrium, Equilibrant, Formulae for resultant of forces and resolution of a force. Numerical problems on resultant of forces. Equilibrium of coplanar concurrent force system: Conditions of equilibrium, Action & Reaction, Free body diagram, Lamis' theorem. Numerical problems on equilibrium of forces.

3. Coplanar non-concurrent force system **5hrs**

Resultant of a force system: Moment, moment of a force, couple, moment of a couple, Characteristics of couple, Equivalent force-couple system, Numerical problems on moment of forces and couples, on equivalent force-couple system. Varignons principle of moments, Resultant of coplanar- non-concurrent force systems and numerical problems.

Unit II

4. Equilibrium of a force system (Chapter 3 contd..) **5hrs**

Conditions of equilibrium, types of support and loading for a statically determinate beam, Reactions at support connections, Numerical problems on equilibrium of force systems and support reactions for a statically determinate beam.

5. Static Friction **8hrs**

Introduction, types of friction, definition, limiting friction, coefficient of friction, laws of Coulomb friction, angle of friction and angle of repose, cone of friction. Wedge and belt friction theory. Derivation of belt friction formula. Numerical problems on, impending motion on horizontal and inclined planes (including connected bodies); wedge friction; Ladder friction and Belt friction.

6. Centroid of Plane Figures **5hrs**

Introduction, Definition, Methods of determining the centroid, axis of reference, axis of symmetry, Locating the centroid of simple plane figures (triangle, semicircle, quarter of a circle

and sector of a circle etc,.) using method of integration, Numerical problems on Centroid of simple built up sections.

Program: BE Civil Engineering	**Unit III**	**Semester: II**
Course Title: Computer Aided Engineering Drawing		**Course Code:15EMEP101**
L:T:P: 0:0:3	**Credits: 03**	**Contact Hours: 06 Hrs/Week**
ISA Marks:80	**ESA Marks:20**	**Total Marks:100**
Teaching Hours:50	**Examination Duration: 3Hrs**	

Introduction, Definition, Method of determining the second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc,.) using second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc,.) using

Unit I

1: Introduction to engineering drawing and orthographic projections. 8hrs

(Manual Drafting)

i)Introduction to engineering drawing – BIS conventions.

ii)Orthographic projections: first angle projection and third angle projection – symbolic representation.

iii)Projections of points.

iv)Projections of lines inclined to both the planes and determination of true length by rotating the view method (Problems on traces of a line and mid-point problems are not included). However application problems are included.

v)Projection of planes: Planes parallel to one plane and perpendicular to other plane or perpendicular to one plane and inclined to other plane (Two stage problems).

vi)Projection of simple solids such as prisms, pyramids, cylinders, cones and sphere and their frustums in simple positions (Base parallel to or in one of the three planes).

2. Development of lateral surfaces of solids. (MANUAL) 7hrs

i) Development of lateral surface of prisms and cylinders (Either full or truncated using parallel line development method)

ii) Development of lateral surface of pyramids and cones (Either full or truncated or of their frustums using radial line development method)

iii) Development of lateral surfaces of spheres using both the methods and development of transition pieces.

3. Conversion of pictorial views into orthographic projections using CAD software. 6hrs

Drawing orthographic projection of objects shown in pictorial views by first angle method of projection using CAD software. (2D drafting only)

4. Isometric projection or view using CAD software. 4hrs

Drawing isometric projections or views of objects shown in orthographic projections using CAD software.

Text Books

1.Text Book of Engineering Drawing by K R Gopalakrishna

2.Text Book of Engineering Drawing by N D Bhatt and V M Panchal

Program: BE Civil Engineering		Semester: II
Course Title: Engineering Chemistry		Course Code:23ECHB101
L-T-P: 3-0-0	Credits: 03	Contact Hours:40
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:40	Examination Duration: 3Hrs	

Unit I

1. Pure substances **08 hrs**

Properties of pure substance (Steam), two property rule, T-H diagram, formation of steam at constant pressure. Different states of steam: Wet steam-dryness fraction, determination by separating-throttling calorimeter, Dry saturated steam, Superheated steam, thermodynamic parameters of steam, steam table, numerical problems. T-V, P-V & P-T diagrams of pure substance taking water as example. Triple point & critical point. Sub-cooled liquid, saturated liquid, mixture of saturated liquid & vapor, Saturated vapor & superheated vapor states.

2. Real and ideal gases **05 hrs**

Properties of Real and Ideal gases. Vander Waal's equation, Vander Waal's constant in terms of critical properties –numerical problems. Compressibility factor, compressibility chart and Law of corresponding state. Ideal gas: equation of state, internal energy and enthalpy as functions of temperature. Ideal gas mixture: Dalton's law of additive pressures and Amagat's law of additive volumes. Terms used in the analysis of mixture of gases - numerical problems.

3. Engineering Materials **03 hrs**

Ferrous metals – properties and applications of Iron and Steel. Ferrous metal s – properties and Applications of copper and aluminium. Cement- properties, mechanism of setting & hardening of cement and applications. Lubricants- Properties –viscosity, flash point, fire point, cloud point and pour point, mechanism- hydrodynamic and boundary lubrication and applications.

Unit II

4. Fuel Chemistry **06Hrs**

Fuels, classification, determination of calorific value of a fuel (solid / liquid fuel by Bomb calorimeter), coal analysis- Numerical problems. Petroleum - cracking, Octane number, Cetane number, reforming, and mechanism of knocking in Petrol and Diesel engines. Renewable energy sources – power alcohol and bio diesel.

5. Energy Storage and Conversion Systems **06Hrs**

Electrode potential, Nernst equation, Formation of a cell; Reference electrodes – Calomel electrode and Determination of electrode potential using calomel electrode, numerical problems on E, Ecell,, E0cell.

Batteries: Classification, characteristics, Lead-acid and Li ion batteries.

Fuel cells: Methanol-O2 fuel cell.

6. Surface Chemistry **04Hrs**

Corrosion: Electrochemical theory of corrosion taking iron as an example; corrosion control – galvanization and tinning.

Metal Finishing: Technological importance of metal finishing, Electroplating, factors affecting nature of electrodeposit- Throwing power of plating bath solution- numerical problems. Electro less plating – advantages over electroplating, lector less plating of copper and its applications in the manufacture of printed circuit board.

Unit III

7. Polymers **04 Hrs**

Introduction, free radical mechanism of addition polymerization taking Ethylene as an example; commercial polymers - Plexi glass, polyurethane and polystyrene. Adhesives – synthesis, properties as applications of Epoxy resins; Polymer Composites - structure, properties and applications of Kevlar and carbon fiber.

8. Environmental Chemistry **06 Hrs**

Water: Sources and ill effects of water pollutants- fluoride and nitrate; Determination of total hardness of water by EDTS method – numerical problems. Sewage: Determination of biological oxygen demand by Winkler's method – numerical problems and determination of chemical oxygen demand - numerical problems,

Text Books

1. A text Book of Engineering Chemistry, 1st edition, Dara. S. S, S. Chand & Co. Ltd., 2009, New Delhi.
2. A text Book of Engineering Chemistry, 16th edition, Jain P.C and Jain M, Dhanpat Rai Publications, 2006, New Delhi.

Reference Books:

1. An introduction to Thermodynamics, Y V C Rao, Revised Edition, University Press, 2009 Hyderabad.
2. Hand book of batteries , David Linden, Thomas B Reddy, 3rd edition McGraw Hill publications, 2001.
3. Puri B. R., Sharma L.R. and Pathania M. S., Principles of Physical Chemistry, 33rd Edition, S Nagin Chand & Co.,1992.
4. Fontana M G, Corrosion Engineering, 3rd Edition, McGraw Hill Publications, 1986.
5. Billmeyer F W, Text Book of Polymer Science, John Wiley &Son's, 1994.
6. Principles of Polymer Chemistry- A. Ravve Plelum Press, New York and London.
7. Callister William D, Materials Science and Engineering: An introduction, John Wiley and Sons 2007: 721 pages.

Program: BE Civil Engineering		**Semester: II**
Course Title: Professional Communication		**Course Code: 15EHSH101**
L-T-P: 0-0-2	**Credits: 02**	**Contact Hours: 42**
ISA Marks:80	**ESA Marks:20**	**Total Marks:100**
Teaching Hours: 42	**Examination Duration: 3Hrs**	

Unit I

1. Basics- English Communication **9 hrs**

Course Introduction, Explanation of template mix-ups with correct usages & necessity of grammar in error detection, Usage of tenses

2. Vocabulary and grammar **6 hrs**

Vocabulary, Word Formation and Active and Passive Voice

3. Bouncing Practice **6 hrs**

Definition and types of bouncing and its practice with examples, reading skills, free style speech. Individual presentation.

4. Rephrasing and Structures **8 hrs**

Comprehension and Rephrasing, PNQ Paradigm and Structural practice

5. Dialogues **3 hrs**

Introduction of dialogues, Situational Role plays,

6. Business Communication **10 hrs**

Covering letter, formal letters, Construction of paragraphs on any given general topic.

Reference Books:

1. Collins Cobuild Advanced Learner's English Dictionary
2. Raymond Murphy - Intermediate English Grammar, Cambridge University Press
3. Martin Hewings- Advanced English Grammar, Cambridge University Press.

Program: BE Civil Engineering		Semester: II
Course Title: Problem Solving with Data Structures		Course Code:18ECSP102
L-T-P: 0-0-3	Credits: 03	Contact Hours: 6 hrs / week
ISA Marks:80	ESA Marks:20	Total Marks:100
Teaching Hours: 78	Examination Duration: 3Hrs	

Unit I

1.Introduction to Data Structures **15 Hrs**

Review of C: Structures, Pointers, Dynamic Memory Allocation and File Manipulation Operations, Introduction to Data Structures, Data structure Operations.

2.Lists **18 Hrs**

Concept of lists: Abstract data type, Definition, Representation of linked lists in Memory, Variants of Lists: Singly Linked List, Doubly Linked lists, Circular linked lists, Operations: Traversing, Searching, Insertion and Deletion. Applications of Linked lists – Polynomials, long integer addition and other applications.

3.Stacks and Recursion **18 Hrs**

Stack: Definition, Operations, Stack ADT Implementation of stack operations. Polish notation:Infix to postfix conversion, evaluation of postfix expression, parenthesis matching and otherapplications. Recursion

4.Queues **15 Hrs**

Queue: Definitions, Queue ADT, Variants of Queues: Linear queue, circular queue, priority queue, double ended queue and multiple queues. Applications of queue.

5.Binary trees **12 Hrs**

BinaryTree: Definition, Terminology and representation, Binary Search Tree:Traversals and its applications.

Text Books

1. Data Structures Using C and C++ - Y. Langsam, M. Augenstein And A. M. Tenenbaum, Prentice - Hall of India Pvt. Ltd. Edition- 2, 2006
2. Data Structures with C -- Seymour Lipschutz, Tata McGraw Hill India LTD, EdItion-1, 2011

Reference Books:

1. Data Structures and Algorithms Made Easy – Narshiman Karumunchi, Career Monk Publications, Edition-2, 2017.
2. Data Structure Through C - Yashavant P Kanetkar, BPB Publication, Edition-2.
3. Problem Solving in Data structures and Algorithms Using C – Hemath Jain, Taran Technologies Private Limited, Edition-1, 2016
4. Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. The MIT Press, Edition-3, 2009.
5. Data Structures through C in Depth, S.K. Srivastava, Deepali Srivastava, BPB Publications, 2004
6. Online platform: www.Hackerrank.com
7. https://www.geeksforgeeks.org/

Program: BE Civil Engineering		Semester: II
Course Title: Design Thinking for Social Innovation		Course Code:20EHSP101
L-T-P: 0-1-1	Credits: 02	Contact Hours: 4 hrs / week
ISA Marks:80	ESA Marks:20	Total Marks:100
Teaching Hours: 38	Examination Duration: 3Hrs	

Unit I

1.Introduction **2 Hrs**

Introduction to Design thinking through case studies; Its Significance, Goals, and phases

2.Empathy **6 Hrs**

What is Empathy, Need for Empathy, Ways to empathize, interaction protocol, Interview questionnaire for target groups, and Empathy map

Community Visit 6 Hrs

Social challenge identification

3.Define **6 Hrs**

Stakeholders and their needs, Stakeholder personas, Problem definition and its scope, Point of View (PoV).

4.Ideate **6 Hrs**

Significance of ideation; Systems perspective to a solution: Cause & Effect, Input-Process-Output, Past-Present-Future; Tools to ideate: Brainstorming and SCAMPER; Idea Evaluation

5.Prototype **6 Hrs**

Significance of Prototyping, Generation of specifications, User-centric approach to finalizing specifications, Prototype-building

6.Testing **4 Hrs**

Test plan, User-experience feedback and iteration process; Refining solution using Plan, do, Check and Act model; Identify limitations and scope for further improvement

Community Visit 2 Hrs

Stakeholder interaction and feedback

Text Books

1. Lewrick, M., Link, P., & Leifer, L. (2020). The design thinking toolbox: A guide to mastering the most popular and valueble innovation methods. John Wiley & Sons.

Reference Books:

1. Mueller-Roterberg, C. (2018). Handbook of Design Thinking: Tips & Tools for How to Design Thinking, Eugene, OR, Amazon Digital Services LLC.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.

Program: BE Civil Engineering		Semester: III
Course Title: Laplace transforms and Statistics		Course Code:20EMAB202
L-T-P: 4-0-0	Credits: 04	Contact Hours:50
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:04	Examination Duration: 3Hrs	

Unit I

1. Laplace Transforms **10 Hrs**

Definition, transforms of elementary functions- transforms of derivatives and integrals- Properties. Periodic functions, Unit step functions and Unit impulse functions.

Inverse Transforms- properties- Initial and Final value theorems, examples, Convolution Theorem. Applications to differential equations.

2.Curve fitting and regression **05 Hrs**

Introduction to method of least squares, fitting of curves $\boldsymbol{y = a + bx}$, $\boldsymbol{y = ab^x}$, $\boldsymbol{y = a + bx + cx^2}$ Correlation and regression. Applications to Civil Engineering problems: fluid flow through a pipe problem-using curve.

3.Probability **05 Hrs**

Definition of probability, addition rule, conditional probability, multiplication rule, Baye's rule. (no proof)

Unit II

4.Random variable and Probability distributions **05 Hrs**

Discrete and continuous random variables- PDF-CDF- Binomial, Poisson and Normal distributions (Problems only).

5.Tests of hypothesis **15 Hrs**

Sampling, Sampling distribution, Standard error, Null and alternate hypothesis, Type -I and Type-II errors, Level of significance. Confidence limits, testing of hypothesis for single mean and difference of means (large samples). t-test (test for single mean, paired t-test), Chi Squared distribution, analysis of variance (one-way and two-way classifications). Case studies of designs of experiments (CRD, RBD). Applications to civil Engineering problems

Unit III

6. Simulation **10 Hrs**

Introduction, methodology of simulation, simulation models, Event type simulation, Generation of random numbers, Monte Carlo simulation, Simulation of Inventory Problems, Simulation of Queuing system, Simulation of Networks.

Text Books

1 J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Ed, TATA McGraw-Hill Edition 2007.

2 Kreyszig, E, Advanced Engineering Mathematics, 8ed, John Wiley & sons, 2003.
3 Kishor S Trivedi, probability and statistics with reliability queuing and computer science applications, PHI, 2000

Reference Books:

1. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 9ed, Sultan Chand & Sons, New Delhi, 2002
2. Miller, Freud and Johnson, Probability and Statistics for Engineering by, 5ed, PHI publications, 2000.
3. Potter M C, Jack Goldberg and Aboufadel E F, Advanced Engineering Mathematics, 3ed, Oxford Indian Edition, 2005.

(Use this template for all courses, semester wise)

KLE Technological University
Creating Value, Leveraging Knowledge

Program: Civil Engineering		Semester: III
Course Title: Mechanics of Fluids		Course Code: 15ECVF201
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 50	Examination Duration: 3hrs	

Unit I

1. Fluid Properties and Classification of Fluid **5 hrs**

Introduction to fluid mechanics, Systems of units, Properties of fluid - Mass density, Specific Volume, Specific Weight, Relative density, Viscosity, Newton's law of viscosity, Compressibility, Vapor pressure, Surface tension, Capillarity. Newtonian and Non-Newtonian Fluids, Ideal and Real fluids.

2. Fluid Pressure and its Measurement **5 hrs**

Definition of pressure with its units and dimensions, pressure at a point. Pascal's law, Hydrostatic pressure law. Different types of pressures, Measurement of pressure, Classification- Simple manometers, Differential manometer and Micro Manometer

3. Hydrostatics **5 hrs**

Definition of total pressure, Center of pressure, Centroid, depth of center of pressure, Hydrostatic force on plane surface submerged horizontally, vertically and inclined. Hydrostatic force on submerged curved surface. Archimedes principle.

4. Kinematics of Fluids **5 hrs**

Description of fluid flow - Lagrangian and Eulerian approaches. Classification of flow; Definition of path line, streamline, streak line, stream tube. Acceleration of flow in one dimensional flow. Continuity equation in differential form. Velocity potential, Stream functions, Stream line, Equipotential line. Relation between velocity potential and stream function. Laplace equation.

method and double plane method

Unit II

5. Dynamics of Fluid Flow **8 hrs**

Concept of inertia force and other forces causing motion. Derivation of Euler's equation and Bernoulli's equation with assumption and limitation. Application of Bernoulli's equation, Venturimeter, Orifice meter, Pitot tube.

4. Tachometric Surveying **04 hrs**

Basic principle of stadia tachometer, tacheometric equations for horizontal line of sight, on inclined line of sight (LOS), when staff vertical to LOS and when staff normal to LOS

Experimentation on: Verification of Bernoulli's equation.

Windows: Types - Paneled, Glazed, Bat window, Dormer window, Louvered and corner window,

Unit II

6. Flow through Pipes and open Channels **12 hrs**

[illegible] flow in open channels, Geometric properties of Rectangular, Triangular, Trapezoidal and Circular channels. Chezy's equation, Manning's equation. Most economical open channels. [illegible]

7. Plastering and Painting **05 hrs**

Plastering: Purpose of Plastering, Materials of plastering, Lime mortar, Cement Mortar, [illegible] Lath plastering.

5. Modern Surveying Instruments **08 hrs**

Unit III

7. Dimensional Analysis and Model Studies **5 hrs**

Introduction, Systems of units, Dimensions of quantities, Dimensional Homogeneity of an equation. Analysis- Raleigh's method, Buckingham's Π theorem. Non-dimensional numbers: Froude Models, Reynold's models

8. Discharge Measurements **5 hrs**

Flow through orifices and its classification, hydraulic coefficients and their relationship, Flow through mouthpieces and its classification. Classification of notches and weirs. Discharge over rectangular, triangular and trapezoidal notches or weirs. Discharge over a broad crested weir, Ogee weir and submerged weir. Current meter and its applications. Estimation of discharge with electronic or sensor devices.

Text Books:

1. Arora, K. R., Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Book House, New Delhi, 9th ed.2010.
2. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Revised 9ed. Lakshmi Publications, New Delhi, 2019.
3. Daugherty, R.L., Franzini, J.B., Finnemore, E.J. Fluid Mechanics with Engineering Applications, 10th edition, McGraw Hill Publishing Co. Inc., New York, 2010.
4. Modi, P.N. and Seth S.M., Hydraulics and fluid mechanics, 22nd ed. Standard book house, New Delhi, 2019.

7. Introduction to Photogrammetry and Remote Sensing **05 hrs**

Terrestrial and Aerial photographs, Photo interpretation, Stereoscopy. Remote Sensing: Principle, Idealized remote sensing system, Types, applications. Introduction and applications of LIDAR.

8. Modern methods of Surveying **05 hrs**

Satellite-based Positioning System, Global Positioning System (GPS), basic principles, satellite configuration, position fixing using satellite signals, receivers, precise time and accuracy, Differential Global Positioning System (DGPS), and its applications in surveying, Introduction to GIS (Geographic Information System): Components, software, data, users,

Reference Books:

1. Domkundwar V. M. and Domkundwar A. V., Fluid Mechanics and Hydraulic
2. Machines, 5 th ed., Dhanpat Rai & Co., 2014.Douglas J.F., Gasiorek J.M., and Swaffield J.A.., Fluid Mechanics, 5ed., Pearson Education, India, 2006.
3. Streeter V.L. and Wylie E. B., Fluid Mechanics, McGraw Hill Education, London, 9ed., 2010.

2. Jagadeesh, K.S., Venkatarama Reddy, B.V. and Nanjunda Rao, K.S., Alternative Building Materials and Technologies, New Age International (P) Ltd., New Delhi, 2007.
3. National Building Code of India 2016, Bureau of Indian Standards
4. CBRI, Roorkee, Advances in Building Materials and Construction.

2. Bhavikatti, S.S., Surveying and levelling, Volume I and II, I.K. International Publishers, New Delhi, 2019.
3. Duggal, S.K., 'Surveying' Volume I and II, Tata McGraw Hill, 2017, New Delhi.
4. W. Schofield 'Engineering Surveying' Fifth Edition, Butterworth-Heinemann, 2001.
5. Lille Sand, John Wiley and Sons, Remote Sensing and Image Interpretation, 7th Edition, 2015.
6. Chandra, A.M., Plane Surveying, 3ed. New Age India Ltd. 2015.

Reference Books:

1. T.P. Kannetkar and S.V. Kulkarni , 'Surveying and Levelling Vol. I and II', Pune Vidyarthi Griha Prakashan, 2006
2. Anderson, J. M. and Mikhail E. M., Introduction to Surveying, TMH, New York.
3. M. Anjireddy, Remote Sensing and Geographical Information Systems, 4th Edition, BS Publications, 2012.
4. Roy, S.K., Fundamentals of Surveying, Prentice Hall of India, 2010.
5. E-notes: https://sites.google.com/a/mitr.iitm.ac.in/iitmcivil/ce2080, 2015.

Program: Civil Engineering		**Semester: III**
Course Title: Mechanics of Materials		**Course Code: 15ECVF202**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40	**Examination Duration: 3hrs**	

Unit I

1: Simple Stress and Strain. **05 hrs**

Introduction, FBD & Equilibrium Equations Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain Diagram for structural steel, concrete and non-ferrous materials, Elastic constants, relationship among elastic constants, Principles of superposition, Deformation of Prismatic bar, Elongation due to self – weight.

2: Compound Stress and Strain **09 hrs**

Composite section, Volumetric strain, expression for volumetric strain, Stress components on inclined planes, General two-dimensional stress system, Principal planes and stresses, Mohr Circle. Thermal stresses (including thermal stresses in compound bars), thin cylinders subjected to pressure, change in length, diameter and volume, thick cylinders.

3: Bending Moment and Shear Force in Beams **06 hrs**

Introduction, Types of beams, loads and supports, Shear force and Bending moment, Relationship between load, shear force and bending moment, SFD and BMD with salient values for cantilever beams & simply supported beams subjected to point loads, UDL, UVL and Couple.

Unit II

4: Bending Moment and Shear Force in Frames **06 hrs**

SFD and BMD with salient values for Overhanging beams & Portal Frames subjected to point loads, UDL, UVL and Couple.

5: Stresses in Beams **06 hrs**

Introduction – Assumptions in simple bending theory, Pure bending, Bending stress in beam, Section modulus, Flexural rigidity, Expression for shear stress in beams, Bending & Shear stress diagram for rectangular, 'I' and 'T' section.

6: Deflection of Beams **06 hrs**

Introduction – Definitions of slope & deflection, Elastic curve derivation of differential equation of flexure, Sign convention, Slope and deflection for standard loading classes using Macaulay's method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.

Unit III

7: Torsion of Circular Shafts **05 hrs**

Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections.

8: Columns and Struts **07 hrs**

Introduction – Short and long columns, Assumptions made in Euler's theory on columns, Effective length, slenderness ratio, radius of gyration, buckling load, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula and problems.

Text Books

1. Barry J. Goodno/James M. Gere, Mechanics of Materials, Enhanced ed., Cengage Learning India Pvt. Ltd., 2022.
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Strength of Materials, 10ed., Lakshmi Publications, New Delhi, 2021.
3. Ferdinand Pierre Beer, Elwood Russell Johnston, John T. DeWolf, David Francis Mazurek, Sanjeev Sanghi, Mechanics of Materials, 9ed., McGraw-Hill, 2020.
4. Bhavikatti, S.S., Strength of Materials, 4ed., Vikas Publishers, New Delhi 2013.

Reference Books:

1. S. Timoshenko, Strength of Materials: Elementary Theory and Problems - Part I, 3ed., CBS Publishers and Distributors Pvt. Ltd., New Delhi, 2021.
2. Bansal R.K, A Text book of Strength of Materials, 6ed., Laxmi Publication, New Delhi, 2017
3. Beer. F. Johnston, John T. DeWolf, Mazurek D.F., Mechanics of Materials, 7ed., McGraw Hill Publishing Co. Inc., 2014.
4. Basavarajaiah B.S. and Mahadevappa P., Strength of Materials in SI units, 3ed., CBS Publishers, New Delhi, 2011.

Program: Civil Engineering		Semester: III
Course Title: Survey Practice - I		Course Code: 17ECVP201
L-T-P: 0-0-1	Credits: 1	Contact Hours: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 30	Examination Duration: 3hrs	

Demonstrations

1. Study of chain, tape, Ranging rod, Direct Ranging, Dumpy level, Compass and EDM (Total Station) device.
2. To locate contour by direct and indirect method.

Experiments

1. Plot the boundary layout of a building by using direct ranging and set out the perpendiculars using chain, tape and cross staff.
2. To mark the center line for different types of civil engineering structures (using closed traverse methods) having different shapes.
3. To locate the various positions of objects (trees, electric pole, drainage) along the center line of a road.
4. To setup the temporary bench marks for a given topography using Auto level.
5. To determine difference in elevation between two points using reciprocal leveling and determine the collimation error.
6. To conduct profile leveling for water supply / sewage line / road alignment and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level using auto level and total station.

Open Ended Experiments:

Your company has received a tender on survey work to fix up the plinth level for proposed residential building on a sloping terrain, produce a detailed report for the same.

Reference Books:

1. Bhavikatti S.S., Surveying and Levelling Vol-I & II,.2nd ed., Wiley Publishers, New Delhi, 2019.
2. Punmia, B.C., Ashok.K Jain, Arun.K., Surveying Vol. l & 2, 15ed., Laxmi Publishers, New Delhi-2016.
3. Duggal S. K, 'Surveying' volume I & II, 4th ed., Tata McGraw Hill, 2017, New Delhi
4. https://sites.google.com/a/mitr.iitm.ac.in/iitmcivil/ce2080
5. SP:7, National Building Code of India, Bureau of Indian Standards, 2016

Program: Civil Engineering		**Semester: III**
Course Title: Building Engineering Drawing		**Course Code: 24ECVP201**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 3 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks:100**
Teaching Hours: 30	**Examination Duration: 3hrs**	

1. Introduction to NBC, Building Bye Laws, Model space and paper space, Bubble diagram, Zoning regulations and Commercial Development Plan (CDP)

2. Bubble diagram with circulation for a residential building

3. Prepare a working drawing indicating water supply, sanitary, rainwater recharging and harvesting system for the following types of buildings;
a) Residential building
b) Educational building
c) Institutional building

4. Draw water supply, sanitary system and rainwater recharging and harvesting system using By Layer command in AutoCAD for different types of buildings.

5. Draw bubble diagram with circulation suing AutoCAD for different types of buildings.

Open Ended Experiment
A client has approached to construct a residential building on a sloping terrain, produce an engineering drawing for the project, collect all/any required data as per the need for the project and draw a plan considering proper air circulation and natural lighting so that the energy demand will be less during the maintenance phase of the structure.

Reference Books:

1. Bethune, J. D., Engineering Graphics with AutoCAD, Pearson Education Publishers, 2017.
2. Chandra, A.M and Chandra, S., Engineering Graphics with AutoCAD, 2ed., Pearson Education Publishers, 2004.
3. Gurcharan Singh., Civil Engineering Drawing, 7ed., Standard Publishers Distributors, 2014.
4. N. Kumara Swamy, A. Kameswara Rao, Building Planning and Drawing, Charator Publishing House Pvt. Ltd., 2007.
5. Shah, M.H and Kale, C.M, Building Drawing, Tata Mc Graw Hill Publishing Co. Ltd., 2012.
6. Malik R S and Meo G S, Civil Engineering Drawing, 2ed, Asian Publishers/Computech Publications Pvt Ltd, 2010.
7. SP:7, National Building Code of India, Bureau of Indian Standards, 2016

Program: Civil Engineering		**Semester: III**
Course Title: Material Testing Lab		**Course Code: 21ECVP201**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 3 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks:100**
Teaching Hours: 30	**Examination Duration: 3hrs**	

Mechanical properties of materials

1. Tension test on Mild steel and HYSD bars.
2. Compression test of Mild Steel, Cast Iron and HYSD bars.
3. Compression test on concrete blocks and Cylinders, Paver blocks.
4. Test on bricks and tiles.
5. Impact tests on Mild Steel. (Charpy & Izode).
6. Flexural Test on Wood, Concrete beam, RCC Beams.
7. Shear Test on Mild steel.
8. Hardness tests on ferrous and non-ferrous metals – Brinell's and Rockwell.
9. Torsion test on Mild Steel circular sections.
10. Non-Destructive Test on Concrete by Rebound hammer, UPV, Profometer.

Reference Books:

1. Bhavikatti S.S., Strength of materials, 4ed., Vikas Publishing House, 2018.
2. Gambhir M L and Neha Jamwal, Building and construction materials- Testing and Quality control McGraw Education India Pvt. Ltd., 2017
3. Kukreja C B, Kishore K., and Ravi Chawla Material Testing Laboratory Manual for quality control, Standard Publishers & Distributors, 2016.
4. Suryanarayana A K, Testing of Metallic Materials", Vedams ebooks Pvt. Ltd. New Delhi, 2007.

IS Codes:

1. IS: 1608-2005, Metallic materials - Tensile testing at ambient temperature, Third revision
2. IS: 1768-2008, High strength deformed steel bars and wires for concrete reinforcement-specification, Fourth revision
3. IS: 1499-1979, Method for Charpy Impact test (u-notch) for metals, First revision
4. IS: 1598-19777, Method for Izode Impact test for metals, First revision
5. IS: 1500-2005, Method for Brinell hardness test for metallic materials, Third Revision
6. IS: 5652 – 1993, (Part -1), Hard metals - Rockwell test (scale A), Second Revision
7. IS: 1917-2012, Metallic materials - wire - Simple Torsion test,(Third revision)
8. IS: 1708 -1986, Methods of testing of small clear specimens of timber

Program: BE Civil Engineering		Semester: IV
Course Title: Numerical methods and Partial differential equations		Course Code:15EMAB207
L-T-P: 4-0-0	Credits: 4	Contact Hours:50
ISA Marks: 50	ESA Marks:50	Total Marks:100
Teaching Hours:50	Examination Duration: 3Hrs	

Unit I

1. Interpolation techniques **10 Hrs**

Finite differences, Forward, Backward and central difference operators. Newton Gregory forward and backward interpolation formulae. Sterling's and Bessel's formulae for central difference, Newton's divided difference formula for un equal intervals. Heat transfer problem, gas law problem-shear stress problem-using interpolation.

Python: Interpolation problems related to Mechanical engineering.

2. Matrices and System of linear equations **10 Hrs**

Introduction to system of linear equations, Rank of a matrix by elementary row transformations. Consistency of system of linear equations, solution of system by Direct methods-Gauss elimination, Gauss Jordon method. Solution of homogenous system AX=0, Eigenvalues and Eigenvectors of a matrix.

Python: Matrices, system of linear equations by Gauss elimination, Gauss Jordon and eigenvalue problems

Unit II

3. Partial differential equations **10 Hrs**

Introduction, classification of PDE, Formation of PDE, Solution of equation of the type Pp + Qq = R, Solution of partial differential equation by direct integration methods, method of separation of variables. Modeling: Vibration of one-dimensional string-wave equation and heat equation. Laplace equation. Solution by method of separation of variables.

4. Finite difference method. **10 Hrs**

Finite difference approximations to derivatives, finite difference solution of parabolic PDE explicit and implicit methods, hyperbolic PDE-explicit method, Elliptic PDE-initial-boundary value problems. Engineering Problems: Temperature distribution in a heated plate, vibration of a stretched string, steady-state heat flow.

Unit III

5.Complex analysis: **05 Hrs**

Function of complex variables. Limits, continuity and differentiability. Analytic functions, C-R equations in Cartesian and polar forms, construction of Analytic functions (Cartesian and polar forms).

6.Complex Integration: **05 Hrs**

Line integral, Cauchy's theorem-- corollaries, Cauchy's integral formula. Laurent's Series, Singularities, Poles, Residue theorem – problems.

Text Books

1. Kreyszig E., Advanced Engineering Mathematics, 8ed, John Wiley & sons, 2003.
2. Potter M C, Jack Goldberg and Aboufadel E F, Advanced Engineering Mathematics, 3ed, Oxford Indian Edition, 2005.
3. Grewal B S, Higher Engineering Mathematics, 38ed, TATA McGraw-Hill, 2001.
4. Chapra S C and Canale R P, *Numerical methods for Engineers*, 5ed, TATA McGraw-Hill, 2007

Reference Books:

1. Burden R L and Douglas Faires J, Numerical Analysis, 7ed, Thomson publishers, 2006.
2. Simmons G F and Krantz S G, Differential Equations, TATA McGraw-Hill, 2007.
3. Sastry S S, Introductory method for numerical analysis, 3ed, PHI, 2003.

Program: Civil Engineering		Semester: IV
Course Title: Structural Analysis-I		Course Code: 24ECVC202
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 50	Examination Duration: 3hrs	

Unit I

1. Structural Systems **3 hrs**

Classification of determinate and indeterminate structures, Conditions of equilibrium, Degrees of freedom, Linear and Nonlinear structures, Static and Kinematics indeterminacy of structures. Law of conservation of energy, Principle of virtual work.

2. Deflection of Beams **6 hrs**

Slope and deflection of simply supported and cantilever beams by Moment area method and Conjugate beam method.

3. Strain Energy **7 hrs**

Strain energy and complimentary strain energy, Strain energy due to axial load, bending, Principle of virtual work, The first theorem of Castigliano, Clarke - Maxwell's theorem of reciprocal deflection, Problems on beams frames.

Unit II

4. Analysis of trusses. **9 hrs**

Method of Joints and Method of Sections. Deflection calculations for plane trusses by strain energy and unit load method.

5. Arches **6 hrs**

Three hinged circular and parabolic arches with supports at same levels and at different levels. Determination of thrust, shear and bending moment,

Unit III

6. Suspension cables **4 hrs**

Analysis of cables under point loads and UDL, length of cables - Supports at same level and at different levels.

7. **Influence Line Diagrams** **5 hrs**

Influence line diagrams for simply supported, cantilever and over hanging beams, Influence line diagrams for girders supporting floor beams, Use of Influence line diagrams, Maximum S.F. and B.M. values due to moving loads

Text Books

1. Bhavikatti S.S, Structural Analysis I, 4ed., Vikas Publishing House Pvt. Ltd, Bangalore, 2011
2. Punmia, B. C. Ashok Kumar Jain and Arun Kumar Jain, Mechanics of Materials, Laxmi Publications Pvt. Ltd Ltd, New Delhi, 2005.

Reference Books:

1. Reddy C.S., Basic Structural Analysis, 3ed., Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2017.
2. A.K. Jain, Advanced Structural Analysis, 3ed., Nemchand and Brothers, Roorkee, India, 2015.

3. Leet,, Uang, and Anne M., Fundamentals of Structural Analysis, 3ed., Tata McGraw Hill Publishing Company Inc., New York, 2017.
4. Pandit G. S. and Gupta S. P, Theory of Structures, Vol I & II, Tata McGraw- Hill Publishing Company, New Delhi, 2017.
5. Ramamruthum, S. and Narayan, R., Theory of Structures, Dhanpat Rai Publishing Company, New Delhi, 2017.
6. Prakash Rao D. S., Structural Analysis, A unified approach, 1ed., University Press Limited, Hyderabad, 1996.
7. Timoshenko, S. P. and Young, D. H., Theory of Structures, Tata McGraw Hill Book Company, New York, 1965.

Program: Civil Engineering		Semester: IV
Course Title: Water and Wastewater Engineering		Course Code: 23ECVC201
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 50	Examination Duration: 3hrs	

Unit I

1. Introduction **2 hrs**

Impact of human activities on environment, Water pollution causes, need for protected water supply.

2. Demand and conveyance of water **4 hrs**

Types of water demands, population forecasting- arithmetical, geometrical, incremental increase and simple graphical method. Surface and subsurface sources. Design of the economical diameter of the rising main.

3. Quality of Water **4 hrs**

Concept of safe wholesome and palatability of water, Sampling of water, Examination of Water–Physical, chemical and Biological Examinations. Drinking water standards BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc.

4. Water Treatment **10 hrs**

Treatment flow-charts. Aeration- Principles, types of Aerators. Sedimentation aided Coagulant, design, jar test, Theory of filtration, slow sand, rapid sand and pressure filters, design – excluding under drainage system .Theory of disinfection, types of disinfection.

Unit II

5. Miscellaneous Treatment and Distribution of Water **4 hrs**

Softening methods of removal of hardness by lime soda process and zeolite process. Adsorption technique, reverse osmosis technique, fluoridation and defluoridation.
System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems.

6. Sewerage systems **7 hrs**

Types of sewerage systems. DWF, estimation of storm flow, design of storm water drain. Design of sewers - self cleansing and non-scouring velocities. Design of hydraulic elements for circular sewers flowing full and flowing partially full

7 Sewage characteristics **4 hrs**

Physical, Chemical and Biological characteristics, CNS cycle. BOD and COD their significance

8 Disposal of Sewage **5 hrs**

Self-purification phenomenon, Zones of purification, Oxygen sag curve. Sewage sickness Sewage farming. Numerical Problems on Disposal of Effluents using Streeter Phelps equation

Unit III

9. **Sewage treatment and Sludge Disposal** **10 hrs**

Flow diagram of municipal waste water treatment plant. Preliminary & Primary treatment: Screening, grit chambers, primary sedimentation tanks – Design.

Theory and design of biological unit operation- Trickling filter and Activated sludge process Sludge digestion process, Sludge drying beds.

Text Books

1. Modi P.N., Sewage Treatment and Disposal Engineering, 16th ed. Standard Book House, New Delhi, 2020.
2. CPHEEO: Manual on water supply and treatment, Ministry of Urban Development
3. Garg S.K., Sewage disposal and Air Pollution Engineering, 39th ed., Khanna Publishers, New Delhi.
4. Garg S.K., Water supply Engineering, 34th ed. Khanna Publishers, New Delhi, 2010.
5. Punima B. C., and Jain Ashok, Environmental Engineering-I, Laxmi Publications, New Delhi., 2023
6. Punmia B. C., Jain Ashok K and Arun Kumar Jain, Wastewater Engineering, Laxmi Publications, New Delhi, 2016.

Reference Books:

1. AWWA, Standard Methods Examination of Water and Wastewater, Water Environment Federation, 24th ed.,2023
2. Clair N. Sawyer and L. Perry McCarty, Parkin, G. F., Chemistry for Environmental Engineers, McGraw-Hill, 2004
3. Davis, M.L. and Cornwell, D.A., Introduction to Environmental Engineering, Tata McGraw Hill. 2010
4. Fair, G.M., Geyer J.C., Okan D.A., Elements of Water Supply and Wastewater Disposal, John Wiley and Sons Inc. 2000
5. Hammer M.J., Water and Waste Water Technology, John Wiley and Sons, New York , 2000
6. Howard S. Peavy, Donald R. Rowe, George Techno BanoGlous, Environmental Engineering, McGraw Hill International, 2017.
7. IS:10500-2012,Drinking water- Specification
8. Metcalf & Eddy, Wastewater Treatment Engineering & Reuse, Tata McGraw Hill Publications, 2003.
9.Ministry of Urban Development, Manual on Waste Water Treatment - CPHEEO, New Delhi.
10. Srinivasan, D., Environmental Engineering, PHI Learning Pvt. Ltd., New Delhi, 2008.
11. W.K. Berry, Water Pollution, CBS Publishers Pvt. Ltd ,New Delhi, 2016
12. Andrew Braham, Fundamentals of Sustainability in Civil Engineering, CRC Press, Taylor and Francis Group, 2017

Program: Civil Engineering		Semester: IV
Course Title: Concrete Technology		Course Code: 24ECVC201
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40	Examination Duration: 3hrs	

Unit I

1. Concrete Ingredients **8 hrs**

Cement, Chemical composition, hydration of cement, Types of cement, manufacture of OPC by wet and dry process. Tests on cement, Grades of cement, quality of mixing water. Tests on fine and coarse aggregate.

2. Admixtures **3 hrs**

Chemical admixtures - Super plasticizers, Accelerators, Retarders, Air entraining agents. Mineral admixtures - Fly ash, GGBS, Silica fume, Rice husk ash, etc. Effect of admixtures on cement content.

3. Fresh Concrete **5 hrs**

Workability - Factors affecting workability, Measurement of workability, Slump cone, Compaction factor and Vee-bee consistometer tests, Segregation and bleeding, Process of manufacture of concrete, Curing of concrete, Application of curing compounds.

Unit II

4. Hardened concrete **9 hrs**

Strength properties of concrete, Factors affecting strength, w/c ratio, Gel/space ratio, Maturity concept. Effect of aggregate properties, Bond strength, Modulus of rupture, Effect of accelerated curing, Modulus of Elasticity of concrete, Creep, Shrinkage, Factors affecting creep and shrinkage, Extensibility of concrete, Factors contributing to cracks in concrete.
Non-destructive testing of hardened and aged concrete.

5. Concrete Mix design **07 hrs**

Concept of Mix design, Variables in proportioning, Exposure conditions, Methods of Concrete Mix design, Procedure of mix design as per IS: 10262-2019, Numerical examples of Mix design with river sand and M sand, Mix design and testing of Self-compacting concrete, Pavement Quality Concrete Mix design as per IRC: 44-2017.
Sustainable design of concrete mixtures, Utilization of marginal materials from industry and mining, Comparison with conventional concrete mixtures, Numerical examples.

Unit III

6. Special concretes and concreting methods **8 hrs**

Special Concretes - Constituents, Marginal materials from industry and mining, Properties and advantages of Geopolymer concrete for sustainable construction. Properties and applications of Ferro cement, Light weight concrete, High density concrete, High strength and High-performance concrete, Self-compacting Concrete - EFNARC standards, Fiber reinforced concrete and Ready mixed concrete. Guniting and shotcreting. CFRP and GFRP Composites.

Durability of Concrete Structures - Significance, Permeability, Sulphate attack, Acid attack, Chloride attack, Carbonation, Sorptivity, Freezing and thawing.
Text Books 1. Bhavikatti S. S., Concrete technology, I.K. International Publishing House, 2015. 2. Neville A. M. and Brooks J. J., Concrete technology, 2ed, Prentice Hall Publisher, 2010. 3. Shetty M.S., Concrete technology - Theory and practice, 1ed., S.Chand and company, New Delhi, 2008.
Reference Books: 1. Kumar Mehta P., Paulo J. M. Monteiro - Concrete: Microstructure, Properties, and Material, McGraw Hill publications, 2013. 2. Gambhir M. L., “Concrete Technology”, 3ed., Tata McGraw hill Publishers Pvt. Ltd, New Delhi, 2008.
IS Codes: 1. IS-10262-2019, Recommend guidelines for concrete mix. 2. IS-383:2016, Specifications for Concrete mix aggregates from natural resources for concrete (Third revision). 3. IS-456:2000, Code of practice of plain and reinforced concrete, 4ed., August 2000. 4. IS-516: Method of Tests for Strength of Concrete, 2013. 5. IS-13311-2 (1992): Method of non-destructive testing of concrete-methods of test, Part 2: Rebound hammer

Program: Civil Engineering		Semester: IV
Course Title: Construction Project Management		Course Code: 20ECVC206
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40	Examination Duration: 3hrs	

Unit I

1. Introduction to Construction Project Management **4 hrs**

Evolution of Indian Construction sector, Phases of a construction project, classification of construction works, Necessity of CM, Objectives of civil engineering CM, Functions of management, Importance of construction and construction industry, Employment generation in the construction sector, Participants/stakeholders of a construction project, Scientific methods of construction management.

2. Drawings and Specifications **6 hrs**

Types of Drawings-Architectural and Structural, Study of Scales Used, sequence of dimensioning, dimension lines and figures, Importance of Specifications, General specifications detailed specifications of a typical building. Scope definition using drawings and specifications.

3. Work Breakdown Structure **5 hrs**

Concept of WBS, Common usage of terms, preparing a WBS, Factors to be considered, WBS measurement considerations, Challenges to be considered, WBS level of Detail, WBS life-cycle considerations, Problems – Detailed WBS of a residential building.

Unit II

4. Project Management through Networks **10 hrs**

Introduction, project feasibility, planning methods of projects– Objectives, planning stages. Scheduling, Bar charts and mile stone charts. Introduction, Terms & definitions, Elements of network, types of networks, drawing the network. CPM – Event times, Activity times, floats, critical activity and critical path. Problems. PERT – Introduction, time estimates, expected time, earliest expected time, latest allowable occurrence time, slack, critical path. Probability of completing the project. Problems.

5. Introduction to Sustainability in Construction Engineering **6 hrs**

Overview of Sustainability, Sustainability in construction, Challenges and opportunities. Principle of sustainable design. Green building Standards and Certifications – LEED, BREEAM and GRIHA, Case studies. Materials for sustainable construction. Lifecycle assessment. Sustainable site management. Stakeholder engagement. Emerging trends. Policy and regulations. Future directions.

Unit III

6. Safety Construction Engineering **4 hrs**

Introduction to concept of HSE as applicable to the construction, importance of safety in construction, safety measure to be taken during excavation, hot bituminous work, explosive, drilling & blasting, scaffolds/platforms work & equipment operations. Safety through legislation, safety campaign & insurance.

7. Resource Allocation **5 hrs**

Introduction, Objectives of resource allocation, Methods of resource allocation, Resource smoothing, Steps in resource smoothing, Resource levelling, Steps in resource levelling.

Text Books

1. Kumar Neeraj Jha, Construction Project Management: Theory and Practice, 2ed., Edition, Pearson Publications, 2015.
2. B. L. Gupta, Construction management & machinery, 4ed, Standerd Publishers, 2008

Reference Books:

1. Robert. L Peurifoy and William B. Ledbetter, Construction planning and Equipment& methods, Tata McGraw Hill Pvt. Ltd, New Delhi, 3ed., 2010.
2. Verma Mahesh, Construction planning and Management, Metropolitan Book Co. Delhi, 1982.

Program: Civil Engineering		Semester: IV
Course Title: Hydrology & Irrigation Engineering		Course Code: 15ECVC207
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40	Examination Duration: 3hrs	

Unit I

1. Introduction to Hydrology **06 hrs**

Introduction, Hydrologic cycle, Water budget equation, Precipitation: Forms and type of precipitation, Measurement of precipitation, Selection of rain gauge station. Adequacy of rain gauges, Methods of computing average rainfall, Interpolation of missing rainfall data, Consistency of rainfall data by double mass curve method. Hyetograph and Mass curve of rainfall. Difference between ground water and surface water.

2. Losses from Precipitation **05 hrs**

Evaporation: Factors affecting, Measurement by Class A pan, Estimation using empirical methods. Evapo-transpiration: Factors affecting and Measurement, Estimation using Blaney criddle method and Penman–Monteith equation.
Infiltration: Factors affecting and measurement by double ring infiltrometer, Infiltration indices, Horton's equation of infiltration, Runoff and its estimation.

3. Hydrographs **05 hrs**

Definition, Components of Hydrograph, Base flow separation, Groud water, Darcy's Law, Types of Aquifer, Unit hydrograph and its derivation, S – curve and its computation.

Unit II

4. Introduction to Irrigation **04 hrs**

Definition, Benefits and ill effects of irrigation, Sources of water for irrigation, Systems of irrigation: Surface, Flow irrigation, Lift irrigation, Bandhara irrigation, Micro irrigation, Sprinkler irrigation. Methods of applying water to crops in India.

5. Water Requirements of Crops **04 hrs**

Definition of Duty, Delta and Base period, Relationship between Duty, Delta and Base period, Factors affecting duty of water, Soil-water-plant relationship. Crops and crop seasons in India, Irrigation efficiency, Frequency of irrigation, Definition of gross command area, Culturable command area, Culturable cultivated area.

6. Canals **04 hrs**

Definition, Types of canals, Alignment of canals and canal regulators. Design of canals by Kennedy's and Lacey's methods.
Cross drainage works: Classifications, Diversion Works: definition, layout. Types of weirs and Barrages.

7. Gravity Dams **04 hrs**

Definition, Forces acting on a Gravity dam, Stability Analysis of Gravity Dam, Elementary and practical profile, Low and high gravity dams, Drainage Galleries.

Unit III

8. Earthen Dams **04 hrs**

Introduction, Types of earthen dams, Failure of earthen dams, Drainage arrangements. Phreatic line, determination of phreatic line.

9. Spillways **04 hrs**

Definition, Types of Spillways, Design Principles for an Ogee Spillway. Energy dissipaters, Types of basins.

Text Books

1. Subramanya K., Engineering Hydrology, 4ed., Tata McGraw Hill, New Delhi, 2017.
2. Jayarami Reddy, Text Book of Hydrology, 3ed., Laxmi Publications, New Delhi, 2016.
3. Modi P.N., Irrigation, Water Resources, and Water Power Engineering, Standard Book House, New Delhi, 2004.
4. Punmia B.C. and Pande L., Irrigation and Water Power Engineering, Laxmi Publications, New Delhi, 2021.
5. Raghunath H. M., Hydrology, New Age International Pvt. Ltd., Publication, New Delhi, 2006.

Reference Books:

1. Garg S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publications, New Delhi, 2005.
2. Linsley, Kohler and Paulhus, Applied Hydrology, Wiley Eastern Publication, New Delhi, 1988.
3. Michael A.M., Irrigation Theory and Practices, Vikas Publications, New Delhi, 2004.
4. Sharma R. K., Hydrology and Water Resources Engineering, Oxford and IBH, New Delhi, 2000.

Program: Civil Engineering		Semester: IV
Course Title: Survey Practice - II		Course Code: 15ECVP204
L-T-P: 0-0-1	Credits: 1	Contact Hours: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 30	Examination Duration: 3hrs	

Demonstrations

1. Measurement of horizontal angles with method of repetition and reiteration using theodolite and Total Station, Measurement of vertical angles using theodolite and Total Station.
2. Introduction of GPS.
3. Introduction to GIS, digitization of maps, geo-referencing of topo maps and generating contours.

Experiments

1. To determine the elevation of an object using single plane and double plane method when base is accessible and inaccessible using theodolite and Total station.
2. To set out simple curves using linear methods perpendicular offsets from long chord.
3. To set out simple curves using linear methods by offsets from chords produced.
4. To set out simple curves using Rankine's deflection angles method.
5. To set out compound curve with angular methods.
6. To set out reverse curve between two parallel line with angular methods.

Structured Enquiry

• To set out the center line of columns for different buildings using Total Station.

Open Ended Experiment

• A developer wants to get a landscaping done for a particular area; you as a surveyor are required to develop the layout map of the same area.
• Fix an alignment between two points and produce a detailed report on earthwork.

Reference Books:

1. Bhavikatti S.S., Surveying and Levelling Vol-I & II,.2nd ed., Wiley Publishers, New Delhi, 2019.
2. Punmia, B.C., Ashok.K Jain, Arun.K., Surveying Vol. l & 2, 15ed., Laxmi Publishers, New Delhi-2016.
3. Duggal S. K, 'Surveying' volume I & II, 4th ed., Tata McGraw Hill, 2017, New Delhi

IS Codes:

1. IS 11134:1984(R2000), Code of practice for Setting out of Buildings.
2. SP:7, National Building Code of India, Bureau of Indian Standards, 2016
3. IRC: 73-1980-Geometric Design Standards for Rural (Non Urban) Highways, Indian Road Congress, New Delhi.
4. IRC: 86-1983-Geometric Design Standards for Urban Roads in Plains, India Road Congress, New Delhi.

Program: Civil Engineering		Semester: IV
Course Title: Concrete Laboratory		Course Code: 21ECVP202
L-T-P: 0-0-2	Credits: 2	Contact Hours: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 30	Examination Duration: 3hrs	

I. Tests on Cement:

1. Standard consistency of cement
2. Setting time for cement, and Specific surface of cement by Blaine's air permeability apparatus.
3. Specific gravity of cement and Compressive strength of cement.

II. Tests on Fine and Coarse Aggregate:

4. Specific Gravity and water absorption of fine aggregate. Fineness modulus test for fine, Bulking of sand
5. Specific gravity and water absorption of coarse aggregate, Fineness modulus test for coarse aggregate.

III. Tests on Fresh Concrete and Hardened Concrete:

6. Workability of concrete - Slump, Vee-Bee Consistometer and Compaction factor test, with different water cement ratio without plasticizer.
7. Workability of concrete - Slump, Vee-Bee Consistometer and Compaction factor test with different water cement ratio with plasticizer.
8. Compressive Strength, Tensile strength, Flexural strength of concrete.
9. Self-Compacting Concrete.

IV. Prepare the Concrete Mix Design for different grade of concrete for different exposure condition.

V. Demonstration:

Soundness of cement, Durability and Permeability of concrete

VI. Open Ended Experiment:

• To prepare the concrete mix design apart from conventional concrete, propose the mix proportions, procure the materials, cast and tests

Reference Books:

1. Bhavikatti S.S., Strength of materials, 4ed., Vikas Publishing House, 2018.
2. Gambhir M L and Neha Jamwal, Building and construction materials- Testing and Quality control McGraw Education India Pvt. Ltd., 2017
3. Kukreja C B, Kishore K., and Ravi Chawla Material Testing Laboratory Manual for quality control, Standard Publishers & Distributors, 2016.
4. Suryanarayana A K, Testing of Metallic Materials", Vedams ebooks Pvt. Ltd. New Delhi, 2007.

IS Codes:

IS Code:(For Concrete)

1. IS 10262:2019 : Indian Standard Concrete mix proportioning – guidelines
2. IS 456:2000 Code of practice for plain and reinforced concrete
3. IS 383 : 2016 Specification for coarse and fine aggregates
4. IS 4031 (Part 1 to 6) 1996 (Reaffirmed 2005): Method of physical tests for hydraulic cement
5. IS : 2386 (Part 1 to 5) - 1963 (Reaffirmed 2005): Methods of test for aggregates for concrete
6. IS: 516:1959 (Reaffirmed 2004): Methods of testing for strength of concrete
7. IS 455:1989 (Reaffirmed 1995): Specification for portland slag cement
8. IS 1199 :1999 (Reaffirmed 2004): Methods of sampling and analysis of concrete
9. IS 9103 : 1999 (Reaffirmed 2004): Concrete admixtures - specification
10. IS 10510:1983 Specification for vee-bee consistometer
11. IS 5515:1983 Specification for compaction factor apparatus
12. IS 14858:2000 Compression testing machine used for testing of concrete and mortar requirements

IS Codes for steel

1. IS: 1608-2005, Metallic materials - Tensile testing at ambient temperature, Third revision
2. IS: 1768-2008, High strength deformed steel bars and wires for concrete reinforcement-specification, Fourth revision
3. IS: 1499-1979, Method for Charpy Impact test (u-notch) for metals, First revision
4. IS: 1598-19777, Method for Izode Impact test for metals, First revision
5. IS: 1500-2005, Method for Brinell hardness test for metallic materials, Third Revision
6. IS: 5652 – 1993, (Part -1), Hard metals - Rockwell test (scale A), Second Revision
7. IS: 1917-2012, Metallic materials - wire - Simple Torsion test,(Third revision)
8. IS: 1708 -1986, Methods of testing of small clear specimens of timber

Program: Civil Engineering		Semester: IV
Course Title: Generative AI for Civil Engineering		Course Code: 24ECVP202
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 56	Examination Duration: 3hrs	

Demonstration

1. Introduction to Python: IDEs, UI, data types, variables, loops, and conditionals
2. Lists, tuples, dictionaries, and string operations in Python
3. Functions and Object-Oriented Programming (LOOP) in Python
4. Data analysis and visualization using NumPy, Pandas, and Matplotlib
5. Introduction to Generative AI: Evolution, neural networks, and applications
6. Hands-on with Hugging Face: Exploring text, image, audio, and video generation models
7. Types of Prompting Methods, Crafting Text Prompts, Optimizing Image Prompts, generating Audio and video prompt

Exercise:

1. Experimenting with Text Generation: Understanding transformers and Hugging Face NLP models with different types of prompts
2. Generating content using Hugging Face AI: Code generation and Civil Engineering applications
3. Image Generation: Understanding GANs and Hugging Face image models such as stable diffusion model with different types of prompts
4. Generating AI-based or Civil Engineering visuals using Hugging Face pretrained model with different types of prompts

Structured Enquiry:

1. Text to Text Model: Use of civil engineering Material, optimizing of design using Hugging Face pretrained model with different types of prompts
2. Text to Text Model: Optimizing of design using Hugging Face pretrained model and with different types of prompts
3. Text to image Model: Image showcasing practices adopted in sustainable construction with different types of prompts
4. Text to image Model: Image showcasing safety practices adopted in construction sites with different types of prompt using hugging face models.

Open Ended:

Showcase GenAI Solutions: Project Evaluation

Students will develop and demonstrate a domain-specific GenAI-based solution for a selected civil engineering application, presenting their project along with a structured report that highlights problem-solving approaches, AI implementation, and real-world impact.

Program: Civil Engineering		**Semester: V**
Course Title: Structural Analysis-II		**Course Code: 21ECVC301**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3hrs**	

Unit I

1. Slope Deflection Method **08 hrs**

Introduction, Assumptions, Sign conventions, Derivation of slope deflection equation, Analysis of continuous beams, Analysis of portal frames with and without lateral sway.

2. Moment Distribution Method **08 hrs**

Stiffness and carry over factors, Distribution and carryover of moments, Analysis of continuous Beams, Plane rigid frames with and without sway Support settlement, symmetric frames with symmetric and skew-symmetric loadings

Unit II

3. Stiffness Matrix Method **08 hrs**

Degree of kinematic indeterminacy of one- and two-dimensional structures, generalised coordinates, Analysis of continuous beams with and without sinking of supports and portal frames kinematic redundancy < 3.

4. Flexibility Matrix Method **08 hrs**

Development of element flexibility matrices, Development of global flexibility matrix, Analysis of continuous beams, and rigid plane frames to determine for internal forces and displacements.

Unit III

5. Plastic Analysis **08 hrs**

Introduction, plastic hinge and plastic moment capacity, Assumptions, Shape factor for general sections, Collapse load, Basic theorems for finding collapse loads, Methods of plastic analysis, Beam mechanism for continuous beam.

Text Books

1. Bhavikatti S.S, Structural Analysis II, 4ed., Vikas Publishing House India Pvt. Ltd, Bangalore, 2016.
2. Pandit G.S. and Gupta S.P, Matrix Method of Analysis , 2ed., McGraw Hill Education India Pvt. Ltd, New Delhi, 2008.
3. Reddy C.S., Basic Structural Analysis, 3ed., Tata McGraw Hill Education India Pvt. Ltd New Delhi, 2017.
4. Ramchandra, Design of steel structures-Vol II, 12ed, Standard book house, New Delhi 2015.

Reference Books:

1. Jain A.K., Advanced Structural Analysis, 3ed., Nemchand and Brothers, Roorkee, India, 2015.
2. Leet,, Uang, and Anne M., Fundamentals of Structural Analysis, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2017.
3. Noris, C.H. and Wilbur, J., Elementary Structural Analysis, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2005.

4. Bhavikatti S.S, Matrix Methods of Structural Analysis, 1ed., I K International Publishing House Pvt. Ltd., 2011.
5. Timoshenko, S. and Young, D.H., Theory of Structures, McGraw Hill Company, New York,
6. Beedle, L.S., The Plastic Methods of Structural Analysis, Chapman and Hall, 1977.

Program: Civil Engineering		Semester: V
Course Title: Geotechnical Engineering		**Course Code: 24ECVC301**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3hrs**	

Unit I

1. Introduction to Geology **03 hrs**

Geology in civil engineering, branches of geology, structure of earth and its composition, weathering of rocks, scale of weathering of soils. classification of rocks, engineering properties of rocks-description, occurrence, distribution and their uses.

2. Introduction to Geotechnical Properties of Soils **06 hrs**

Introduction to soil mechanics, phase diagram, basic properties of soils and their inter relationships, index properties of soil -relative density and grain size analysis, Atterberg limits, activity of clay.

3. Classification of Soils and Clay Mineralogy **04 hrs**

Purpose of soil classification, basis for soil classification, unified soil classification, IS classification, Field identification of soils. Types of structure of soil, Valence bonds Soil -Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphus substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

4. Compaction of Soils **03 hrs**

Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control.

Unit II

5. Flow of Water through Soils **05 hrs**

Darcy's law- assumption and validity, coefficient of permeability, factors affecting permeability, permeability of stratified soils, Laplace equation- assumptions and limitations only, Characteristics and uses of flow nets, construct flow nets for sheet pile. effective stress concept, total stress and effective stress, quick sand phenomena.

6. Shear Strength of Soils **07 hrs**

Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelops, total and effective shear strength parameters, sensitivity and thixotropy of clay. shear parameters- direct shear test, unconfined compression test, triaxial compression test under different drainage conditions and vane shear test.

7. Sustainability in Geotechnical Engineering **03 hrs**

Ground improvement techniques using locally available materials for road works, embankments and backfilling, criteria for selection sustainable material, role of sustainable practices in sanitary landfill as liners.

Unit III

8. Consolidation of Soils **05 hrs**

Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations. Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (Cc, av, mv and Cv), Time rate of consolidation. Determination of consolidation characteristics of soils-compression index, and coefficient of consolidation, determination of coefficient of consolidation by square root of time fitting method, logarithmic time fitting method.

9. Stresses in Soils **04 hrs**

Boussinesq's and Westergaard's theories for concentrated, circular, rectangular, line and strip loads. Comparison of Boussinesq's and Westergaard's analysis. Pressure distribution diagrams, contact pressure, Newmark's chart.

Text Books

1. Alam Singh and Chowdhary G.R, Soil Engineering in Theory and Practice, CBS Publishers and Distributors Ltd., 2nd editon, New Delhi, 2019.
2. Braja M Das and Khaled Sobhan , Principles of Geotechnical Engineering, Cengage India Private Limited; 9th edition, 2017
3. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International Private Limited; 4th edition, 2022
4. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxmi Publications; 17th edition, 2019.
5. Chenna Kesavulu N., Textbook of Engineering Geology, Laxmi Publications Pvt Ltd; Third edition, 2018.
6. Gokhale K.V.G.K, Principles of Engineering Geology, B.S. Publications, Hyderabad 2011.

Reference Books:

1. Craig, R.F., Soil Mechanics, Spon Press Publishers, 7th edtition, New York, 2012.
2. Murthy V.N.S., Soil Mechanics and Foundation Engineering, CBSPublishers & Distributors Pvt. Ltd., New Delhi, 2016.
3. Venkatrahmaiah C., Geotechnical Engineering, 6ed., New Age International Pvt. Ltd., New Delhi, 2018.
4. IS - SP-36 (Part – 1) -1987 (R 2006) Compendium of Indian standard on soil engineering Laboratory Testing of Soils for Civil Engineering Purpose

Program: Civil Engineering		**Semester: V**
Course Title: Design of RCC Structures		**Course Code: 15ECVC303**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 50 hrs	**Examination Duration: 3hrs**	

Unit I

1. General Features of Reinforced Concrete **05 hrs**

Introduction, Design Philosophy: Working stress method, Ultimate load method, Principles of working stress and Limit State Design Methods Limit State Method of Design: Design Loads, Load Combination, Materials for Reinforced Concrete, Codal provisions, Concept of Safety Principles of limit states, Factor of Safety, Characteristic design loads, and Characteristic design strength.

2. Limit State of Collapse **11 hrs**

General aspects of Ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of singly reinforced and doubly reinforced rectangular sections, Ultimate flexural strength of flanged sections, Ultimate shear strength of RC sections, Concept of development length and anchorage.

3. Limit State of Serviceability **04 hrs**

General Specifications for design of beams for flexure -Codal provision for sizing of beam, cover to reinforcement-spacing of bars. General aspects of serviceability-Deflection limits in IS: 456 – 2000, Long term and short term deflections, crack width calculation.

Unit II

4. Design of Flexural members. **08 hrs**

General consideration of design of beams, Design examples for Simply supported and Cantilever beams for rectangular, flanged sections, Anchorages of bars, check for development length and deflection, Slenderness limits for beams to ensure lateral stability, Drawing reinforcement details.

5. Design of Slabs **05 hrs**

General consideration of design of slabs, Slabs spanning one direction, and two directions for various boundary conditions, Design of simply supported, cantilever slabs. Design procedures for critical sections for moment and shear and check for deflection, Reinforcement details.

5. Design of Columns **07 hrs**

General aspects, effective length of column, loads on columns, slenderness ratio of columns, minimum eccentricity, design of short axially loaded columns, design of column subject to combined axial load, uniaxial and biaxial moment using SP –16 charts, Reinforcement details

Unit III

6. Design of Isolated footing **06 hrs**

Design of isolated Footing subjected to axial load and uniaxial moment. Design of square footing, rectangular footing, rectangular footing with eccentric loads,
Drawing reinforcement details.

7. Design of Staircase **04 hrs**

General features, types of staircases, loads on stairs, effective span as per IS codal provisions, distribution of loading on different types of stairs, Design of dog legged staircase, Concept of folded staircases, Reinforcement details

Text Books

1. Jain, A.K., Limit State method of design, 7ed., Nemichand and Bros., Roorkee, 2012.
2. Punmia B.C., Ashok Kumar Jain, and Arun Kumar Jain Limit State Design of Reinforced Concrete, Laxmi Publications Pvt. Ltd., New-Delhi-2016.

Reference Books:

1. Bhavikatti, S. S., Design of RCC Structural Elements Vol-I, New Age International Publications, New Delhi, 2016.
2. Krishnaraju, N., Design of Reinforced Concrete Structures (IS: 456 – 2000), 3ed., CBS Publishers, New Delhi, 2016.
3. Robert Park & Thomson, Reinforced Concrete, John Wiley & Bros, 2009.
4. S. Unnikrishnan Pillai and Devdas Menon, Reinforced Concrete Design Third Edition, Tata McGraw Hill Education Pvt. Ltd., New-Delhi-2017.

IS Codes:

1. IS:456-2000, Plain and Reinforced Concrete – Code of Practice, (Fourth Revision) BIS, New Delhi, 2007
2. IS:875 (Part 1 & 2) - 1987, Code of Practice for Design Loads (Other than earthquake) for building and structures, BIS, 1987
3. SP 16: Design Aids for Reinforced Concrete to IS 456:1978.

Program: BE: Civil Engineering / Civil Engineering		Semester: V
Course Title: Construction Economics & Management		Course Code: 19ECVC305
L-T-P: 4-0-0 / 3-0-0	Credits: 4 / 3	Contact Hours: 4 / 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 50 / 40 hrs	Examination Duration: 3 hrs / 3Hrs	

Unit I

1. Construction Economics **10 hrs**

Introduction, economic decision making, Time Value of Money, Cash Flow Diagrams, Using Interest Tables, Evaluating Alternatives by Equivalence, Effect of Taxation on Comparison of Alternatives, Effect of Inflation on Cash Flow, Evaluation of Public Projects: Discussion on Benefit-cost Ratio

2. Economic Sustainability in Construction Economics and Management **04 hrs**

Definition of economic sustainability within the construction industry, Key Principles of Economic Sustainability, Life cycle costing: Techniques for assessing total costs over a project's lifetime, Economic Models and Tools and social benefits of adopting sustainable practices. Risk management: Identifying, analyzing, and managing risks associated with economic

Unit II

3. Project Control **08 hrs**

Determination of unit costs and total cost of a typical construction project. Project Controls – Introduction, Project life cycle, Overview of project life cycle, earned value management, cost performance Index, Schedule performance index, forecasting methods and problems, resource utilization and cumulative curves, Cost loaded schedules.

4. Construction Material Management **04 hrs**

Introduction, Material procurement process in construction organization, material management functions, inventory management, Sustainable procurement – Selecting suppliers and materials that adhere to sustainability standards.

5. Construction Equipment Management **04 hrs**

Introduction, Plant and Equipment Acquisition, Depreciation, Methods of Calculating Depreciation, Example of Depreciation Calculations for Equipment on Site, The Effect of Depreciation and Taxes on Selection of Alternatives, Evaluating Replacement Alternatives.

3. Geometric Design of Highways

Functional design of highways, Cross Section Elements of highways, Sight Distance, Design of Horizontal and Vertical Curves, Introduction to curve alignment, Geometric Design Controls of Expressways. **12 hrs**

Unit II

4. Traffic Engineering

Components of road traffic – vehicle, driver and road, Road user, vehicle and traffic characteristics, Methods of traffic study- equipment used, data collection, analysis and interpretation of speed studies, traffic volume count, origin – destination studies, parking studies, accident studies and features involved in road safety audit system, Traffic flow and roadway capacity – traffic flow characteristics, traffic stream flow characteristics, speed-flow-density relations, concept of PCU, capacity and level of service, Traffic regulations and control – regulations and control on drivers, vehicles and traffic flow, traffic signs, traffic signals, types and design methods, Introduction to Intelligent transport system. **14 hrs**

5. Pavement Materials and Design

Unit III

6. Project Organization **06 hrs**

Introduction, Forms of business organizations, Structure of construction organization, organizing for project management, management levels, traits of a project manager and project coordinator, Factors behind the success of a construction organization.

7. Logistics and Supply Chain Management **04 hrs**

Dimensions of Logistics – Introduction, Macro and Micro Dimension, Macro Dimension, Micro Dimensions, Logistics Activities, Factors Affecting the Cost and Importance of Logistics

and Stabilization techniques in pavement construction, Construction of different types of joints

Program: Civil Engineering		**Semester: V**
Course Title: Highway Engineering Laboratory		**Course Code: 15ECVP301**
Teaching Hours: 28 hrs	**Credits: 1**	**Contact Hours: 2 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks:100**
Teaching Hours: 28 hrs	**Examination Duration: 3 hrs**	

Demonstration Experiment

1. Demonstration of fifth wheel bump integrator, Benkelman beam deflectometer (BBD).

Tests to characterize given aggregates as Highway Construction material

1.Impact Test.
2. Crushing Test.
3. Los Angeles Abrasion Test.
4. Specific Gravity and Water Absorption Test.
5. Aggregate Shape Tests
i. Flakiness Index on aggregate
ii. Elongation Index on aggregate
iii. Angularity Number of aggregate
6. Developing Job mix formula (JMF) as per Rothfutch's method and by using Simple Tool for Aggregate Blending (STAB version 2.0)

Tests to characterize given bitumen sample as Highway Construction material

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and Fire Point Test.
5. Specific Gravity Test.
6. Viscosity Test.

Structured Enquiry Test

1. Confirmation of Moorum as a road subgrade material by measuring its required strength through CBR test.
2. Marshall Mix Design and mix property analysis for bituminous concrete adopting mid gradation method.

Open Ended Experiments

1. Considering current engineering practices, establish procedures for design of different kinds of asphalt mixtures and investigate the performance.

Reference Books:

1. Khanna S.K., Justo C.E.G., and Veeraragavan, A., Highway Materials and Pavement Testing, Nem Chand and Bros, Roorkee

IS Codes

1. IS: (2386-1963) - Methods of test for aggregates for concrete
2. IS: 2720 (part-16) 1979, Laboratory Determination of CBR, Rev.2. Indian standard method of test for soils

3. IS 383:2016 – Specification for coarse and fine aggregates from natural sources
4. IS 2386 (Part 1 to 8) – 1963, Methods of test for aggregates for concrete
IRC 106-1990, Guidelines for capacity of urban roads in plain areas, Indian Roads Congress, New Delhi.
IRC: 99 – 2018 – Guidelines for traffic calming measures in urban and rural areas, Indian Roads Congress, New Delhi.
IRC: SP 88-2019 – Manual on Road Safety Audit, Indian Road Congress, New Delhi.
IRC:SP 126 – 2019 Guidelines for the Design and Construction of Low Volume Rural Roads using Jute Geotextiles Indian Roads Congress, New Delhi.

Program: Civil Engineering		**Semester: V**
Course Title: Environmental Engineering Laboratory		**Course Code:15ECVP302**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks:100**
Teaching Hours: 28 hrs	**Examination Duration: 3hrs**	

1. Determination of Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.
2. Electrical conductivity and pH.
3. Determination of Calcium, Magnesium and Total Hardness
4. Determination of Alkalinity, Acidity
5. Determination of Sulphates, Chlorides
6. Determination of Dissolved Oxygen and BOD.
7 Determination of COD.
8. Determination of Residual Chlorine.
9. Turbidity determination, Jar Test for Optimum Dosage of Alum.
10. Determination of MPN

Reference Books:

1. Standard Methods for Examination of Water and Wastewater, 23rd edition, American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC., 2017
2. Clair Sawyer, Perry McCarty, Gene Parkin, Chemistry for Environmental Engineering and Science, 5th edition, McGraw Hill Education India, 2003

IS Codes:

1. IS 10500:2012, Drinking Water Specification, BIS, New Delhi
2. IS 3025 (Part 62): 2006 Methods of Sampling and Test (Physical & Chemical) for water and waste water, BIS, New Delhi
3. IS 3307:1977, Tolerance Limits For Industrial Effluents Discharged on Land and Irrigation Purpose, BIS, New Delhi

Program: Civil Engineering		Semester: V
Course Title: Computer Aided Design Laboratory		Course Code: 15ECVP305
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 28	Examination Duration: 3hrs	

Students should be able to write coding in MS Excel using VBA, compile the same and run, for simple numerical in various civil engineering fields. They should be able to document the laboratory work in the forms of Flow charts, Algorithms, coding, output of results in tabular/graphical formats.
Also, they should be able to use the available software (SAP) to analyse a simple structure and present the results in tabular/ graphical formats and generate reports.

Using MS Excel and VBA to solve Civil Engineering Problems

Structural Engineering

1. Calculating and plotting shear force and bending moment diagrams for cantilever, simply supported and fixed beams subjected to a combination of loads.
2. Calculation of deflection diagrams for cantilever and simply supported beams subjected to single point loads and UDL.
3. Design of singly and doubly reinforced rectangular sections subjected to bending moment and shear force by using design sheets developed using VBA.
4. Stability of dams.

Surveying

5. Balancing of closed traverse using transit rule
6. Computation of volume of earthwork in cutting and filling.
7. Setting out a horizontal curve by different methods – (i) Offset from long chord (ii) Perpendicular offset from tangents (iii) Radial offsets from tangents

Transportation Engineering

8. Design of super elevation
9. Design of horizontal and vertical alignment

Use of Structural Analysis Software

The student shall analyse the following structures in SAP:
10. Plane truss subjected to dead loads, live loads and wind loads
11. Continuous beam with at least three spans subjected to dead loads and live loads
12. Plane frame subjected to dead loads, live loads and lateral loads.
13.Analysis of two bay two storey structure under static loading conditions (concrete frame).

Reference Books:

Microsoft Excel 2010 Formulas, John Walkenbach, Wiley-India Pvt. Ltd.

Program: BE Civil Engineering		**Semester: V**
Course Title: Mini Project - Extensive Survey		**Course Code: 25ECVW301**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 84 hrs	**Examination Duration: 3 Hrs**	

General instructions

Reconnaissance survey of the sites and perform fly levelling to establish bench marks.
An extensive survey training involving data collection of the existing ground details to carry out the design of Highway Project and Water Supply and Sanitary Project conducted for 4 days. The students should undergo data collection for the following projects:

Highway Project:

Preliminary and detailed investigations to align a three alternative routes (up to 1.5 km stretch) between two given obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road and earthwork estimation.

Water Supply and Sanitary Project:

Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population and carry out water quality analysis. Plotting of village map by using Total station. Location of sites for ground level RL's, overhead tanks underground drainage system, surveys for laying the sewers. Water supply network design using EPANET. Design of Septic tank.

Note:

- The team has to submit a project report consisting of all the drawings for both projects mentioned.
- For the above works Total Station should also be used along with conventional instruments.
- All relevant drawings to be prepared using AUTOCAD and other tools.

Reference Books:

1. Basak N.N., *Text Book of Surveying and levelling,* ,2ed., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
2. Bhavikatti S.S., *Surveying and Leveling Vol-I & II,* I.K. International Publishers, 2016.
3. *CPHEEO: Manual on water supply and treatment*, ministry of urban development, 3ed., 1999.
4. Duggal S.K., *Text Book of Surveying,* 4ed., Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2013.
5. Garg, S.K., *Water supply Engineering*, 20th ed., Khanna Publishers, New Delhi, 2010.
6. Kadiyali, L.R., Traffic Engineering and Transportation Planning, 7ed., Khanna Publishers, New Delhi, 2011.
7. Khanna, S.K., and C.E.G. Justo, & A. Veeraragavan, *Highway Engineering*, 10ed., Nemi

Chand and Bros. Publishers, Roorkee, 2015.

8. Modi, P.N., *Sewage Treatment and Disposal Engg.,* 15ed., Std. Book House, New Delhi, 2015.
9. Punmia B.C., Jain, Ashok K. Jain, Arun K. *Surveying Vol. 1 and Vol-2*, Lakshmi Publishers, 2015.
10. CPHEEO: Manual on water supply and treatment, ministry of urban development, 3ed., 1999.
11. Rossman, L., H. Woo, M. Tryby, F. Shang, R. Janke, AND T. Haxton. EPANET 2.2 User Manual. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/133, 2020.
12. *IRC: 37-2012, Guidelines for the Design of Flexible Pavements (Third Revision)*, Indian Roads Congress, New Delhi.
13. *IRC:15-2011, Construction of Concrete Roads,* Indian Roads Congress, New Delhi.
14. *IRC: 58-2015,Guidelines for the Design of Plain jointed Rigid pavements for highway*, Indian Roads Congress, New Delhi.
15. Standard Methods for Examination of Water and Wastewater, 23rd edition, American Publication – Association, *Water Pollution Control Federation*, American Water Works Association, Washington DC., 2017

Program: Civil Engineering		Semester: VI
Course Title: Design of Steel Structures		Course Code: 25ECVC301
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 50 hrs	Examination Duration: 3hrs	

Unit I

1. Introduction. **08 hrs**

The advantages and disadvantages of Steel structures, Loads and load combinations, structural forms and their classification, Design concepts, and IS code provisions for Design and loads are discussed.

Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis. Steel manufacturing processes, environmental impact, embodied energy, emissions of CO 2 and construction techniques.

2. Structural Fasteners **08 hrs**

Bolted and welded connections, Strength of bolt and bolted joint. Design of bolted connections. Bracket connections. Welded connections, fillet and Butt welds, strength of a weld, its connections.

3. Design of Tension Members **08 hrs**

Axially loaded tension members and their connections, introduction to lug angles, Design of truss ties.

Unit II

4.Design of Compression Members **08 hrs**

Angle struts, Columns including built up sections, Laced and Battened systems. Column splicing, column bases- simple slab base, gusseted base.

5. Design of Flexural Members **08 hrs**

Rolled and built-up sections. Laterally supported and unsupported compression flange. Web crippling and web buckling.

Unit III

6. PEB Structures **05 hrs**

Introduction, advantages and disadvantages of PEB over conventional steel frames, nomenclatures of the structures, international standards, primary and secondary framing system, roof and wall cladding, tapered shapes member & design criteria.

7. Design of Welded Plate Girders **05 hrs**

Introduction, Design of Plate Girders (without intermediate stiffeners)

Text Books

1. Bhavikatti, S.S, Design of Steel Structures, 5ed., New Age International , 2017
2. Duggal S.K , Design of Steel Structures, 2ed., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2016.

Reference Books:

1. Subramanian, N., Design of Steel Structures, 1st, Oxford University Press, New Delhi, 2014.
2. Ramachandra & Virendra Gehlot, Design of Steel Structures, 12ed., Scientific Publishers, New Delhi, 2009.
3. IS 800: 2007 Guidelines for Design of Structural Steel
4. IS 875: 1987 (Part 3) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures: Wind Loads

Program: Civil Engineering		**Semester: VI**
Course Title: Professional Aptitude and Logical Reasoning		**Course Code: 16EHSC301**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3hrs**	

Unit I

Chapter 1. – Arithmetical Reasoning 10hrs
Chapter 2. – Analytical Thinking 4hrs
Chapter 3. – Syllogistic Logic 3hrs

Unit II

Chapter 1. – Verbal Logic 8hrs
Chapter 2. – Non-Verbal Logic 6hrs

Unit III

Chapter 1. - Lateral Thinking 8hrs

Text Books

1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

Unit II

2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

Reference Books:

1. Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India
2. Lateral Thinking – Dr. Edward De Bono, Penguin Books, New Delhi

comparatives for the proposed action.

4. Preparation of Estimates for Truss **06 hrs**

Preparation of detailed estimation and abstract of Steel truss.

5. Rate Analysis **08 hrs**

Definition and purpose, Types of rate analysis, working out quantities and rates for the following standard items of works -earthwork in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and formwork for different RCC items, wood and steel works for doors, windows, and ventilators.

4. Specifications **05 hrs**

Definition of specifications, objective of specifications, standard specifications, essentials of specifications, general and detail specifications of earthwork, burnt brick masonry, cement mortar, plain cement concrete and reinforced cement concrete, specifications of aluminum and wooden partitions, false ceiling, aluminum and fiber doors and windows, various types of claddings.

Unit III

6. Valuation **05 hrs**

Valuation principles: capitalized value, rental value, obsolescence, PWD contract types, tendering, e-procurement, technical sanction, MB preparation, Bill verification and arbitration procedure

Buildings: Masonry structures and framed structures with flat, sloped RCC roofs. Building components (Beams, Columns and Column Footings, RCC Roof Slabs etc) Bar Bending Schedule for RCC works.

Unit III; Taking off in Quantity Surveying; Bill of services; Prime cost; Day work; Provisional sum; Approximate methods of estimating buildings, cost from materials and labour guided by CBRI –examples.

7. Department (PWD) Procedures / Processes **04 hrs**

Types of contract -essentials of contract agreement - legal aspects, penal provisions on breach of contract. Definition of the terms -Tender, E-governance, Standard Bid Document (SBD), E-procurement, KTTP Act, earnest money deposit, security deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders. Duties and liabilities, termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval -Technical sanction. Nominal muster roll, measurement books -procedure for recording and checking measurements - preparation of bills, Arbitration.

Text Books

1. Dutta B.N., Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuation, 28 Rev., ed., CBS Publishers' and Distributors Pvt. Ltd., 2021.
2. Chakraborti, N., Estimating, Costing, specification and valuation in Civil Engg., M. Chakraborti publication 24 ed , Calcutta, 2010..

Reference Books:

1. Birde, G.S., Text book of Estimating & Costing, Dhanpath Rai and Sons. New Delhi, 2014.
2. Kohli D.D. and Kohli, R.C., Text Book of: Estimating and Costing (Civil), 12ed., S. Chand Co. New Delhi, 2013.
3. Public Works Department Schedule of Rates 2018-19.
4. Rangawala S.C., Estimating, Costing and Valuation, Charotar Publishing House, 17ed., 2017.
5. Karnataka Public Works Department Code 2014

Program: Civil Engineering		Semester: VI
Course Title: Advanced Geotechnical Engineering		Course Code: 23ECVE301
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3hrs	

Unit I

1. Flow of Water through Soils **07 hrs**

Darcy's law- assumption and validity, coefficient of permeability and its determination, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, effective stress concept-total stress and effective stress, quick sand phenomena, Capillary Phenomena. Laplace equation- assumptions and limitations only, Characteristics and uses of flownets, Methods of drawing flownets for Dams and sheet piles. Estimating quantity of seepage. Determination of phreatic line in earth dams with and without filter. Piping and protective filter, graded filter.

2. Shear Strength of Soils **08 hrs**

Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelops, Total and effective shear strength parameters, Concept of pore pressure, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay. Measurement of shear parameters- Direct shear test, unconfined compression test, Triaxial compression test and vane shear test, Test under different drainage conditions.

Unit II

3. Consolidation of Soils **06 hrs**

Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations. Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (Cc, av, mv and Cv), Time rate of consolidation. Laboratory one dimensional consolidation test, Determination of consolidation characteristics of soils-compression index, and coefficient of consolidation, determination of coefficient of consolidation by square root of time fitting method, logarithmic time fitting method.

4. Lateral Earth Pressure **06 hrs**

Active and Passive earth pressures, Earth pressure at rest, Earth pressure coefficients. Earth pressure theories- Rankine's and Coulomb's –assumptions and limitations, Graphical solutions for active earth pressure Cullman's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, Earth pressure distribution.

5. Shallow Foundation **04 hrs**

Definitions of ultimate, net and safe bearing capacities, Types of shallow foundation, Allowable bearing pressure. Terzaghi's, Brinch Hansen's and IS Code method bearing capacity equations-assumptions and limitations. Bearing capacity of footing subjected to eccentric loading. Effect of ground water table on bearing capacity. Plate load test, Standard penetration test, cone penetration test. Settlement analysis of foundation, Data for settlement analysis, Settlement of tank foundation.

Unit III

6. Deep Foundation **05 hrs**

Types of Deep foundation. Piles, Drilled Piers and Caissons, Classification of piles, Load carrying capacity of pile. Design of pile and pile groups. Design of pile cap, Settlement Analysis for pile group. Batter piles and under reamed piles. Design aspects of Well foundations.

7. Stability of Earth Slopes **04 hrs**

Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of finite and infinite slopes- Method of slices, Friction Circle method, Fellineous method, Taylor's stability number.

Text Books

1. Alam Singh and Chowdhary G.R. (1994), Soil Engineering in Theory and Practice, 4ed, CBS Publishers and Distributors Ltd., New Delhi, 2018.
2. Braja M. Das, Principles of Geotechnical Engineering, 8ed., Cenage Learning India Pvt. Ltd., India, 2014.
3. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxmi Publications; Seventeenth edition, 2019.
4. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International Private Limited; Fourth edition, 2022

Reference Books:

1. Das. B.M, Principles of Foundation Engineering, 8ed., Thomson Business Information India (P) Ltd., India, 2014
2. Knappett J.A and R.F Craig, Soil Mechanics, 8ed., Van Nostrand Reinhold Co. Ltd., 2012.
3. Murthy, V.N.S., Soil Mechanics and Foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016.
4. Som N.N. and Das S.C, Theory and practice of foundation engineering, PHI learning Pvt Ltd, 2009.
5. Sashi K Gulhati and Manoj Datta, Geotechnical engineering, Tata Mcgraw Hill Education Pvt. Ltd., New Delhi, 2016.
6. Swami Saran, Analysis and Design of Substructures: Limit State Design, 2ed, oxford and IBH Publishing Co. Pvt. Ltd, 2006.
7. Sivakumar Babu G. L., Introduction to Soil Reinforcement and Geosynthetics, Universities Press, Hyderabad, 2006.

IS Codes:

1. IS 8403 : 1981 (Reaffirmed 2002) Code of practice for Determination of Bearing Capacity of Shallow Foundations.
2. IS 2911:1985 Part I to IV (Reaffirmed 1995) Code of Practice for Design and Construction of Pile Foundations.
3. IRC-SP-102-2014-Guidelines for design and construction of reinforced soil walls.

Program: Civil Engineering		Semester: VI
Course Title: Fundamentals of structural dynamics and earthquake engineering		Course Code:23ECVE302
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3hrs	

Unit I

Chapter 1. Introduction **04 hrs**

Introduction to basics of structural dynamics, Basic definition, Nature of dynamic forces, Vibrations and types of vibration, Elements of vibrating system, Equivalent spring stiffness, Equation of motion by D'Alembert's principle, Classification of vibration.

Chapter 2. Undamped Free Vibration of SDOF Systems **04 hrs**

Equation of motion; Response of un-damped SDOF systems, Numerical.

Chapter 3. Damped Free Vibration of SDOF Systems **05 hrs**

Equation of motion; Response of damped SDOF systems; Critical damping; Logarithmic decrement, Numerical.

Unit II

Chapter 4. Undamped Forced Vibration of SDOF Systems **05 hrs**

Equation of motion; Response of undamped SDOF systems to harmonic excitation, Transient response; Steady-state response; frequency ratio; Magnification factor, Resonance.

Chapter 5. Damped Forced Vibration of SDOF Systems **05 hrs**

Equation of motion; Response of damped SDOF systems to harmonic excitation, Transient response; Steady-state response; Dynamic magnification factor, Resonance.

Chapter 6. Multi Degree of Freedom Systems **06 hrs**

Undamped free vibration of multi degree of freedom systems – equations of motion, characteristic equation, natural frequencies and mode shapes; Matrix form of equations of motion, Eigenvalue problem.

Unit III

Chapter 7. Engineering Seismology **05 hrs**

Introduction to basic of earthquake engineering, Earth composition, Causes of earthquakes, Theory of plate tectonics, Elastic rebound theory, Seismic waves, Classification of earthquakes.

Chapter 8. Earthquake Resistant Design of Buildings **06 hrs**

Nature of earthquake force, Philosophy of earthquake resistant design, Calculation of seismic weights, Provisions of IS: 1893 (Part 1)-2016 – General provisions; Seismic zones; Importance factor; Response reduction factor, Equivalent static method, Response spectrum method (no numerical).

Text Books

1. Rao, S.S., Mechanical Vibrations, 4, Addison-Wesley Publishing Co., Reading, Massachusetts, 2004.

Program: Civil Engineering		**Semester: VI**
Course Title: Pavement Engineering		**Course Code: 15ECVE303**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40	**Examination Duration: 3hrs**	

Unit I

1. Introduction to pavement system **04 hrs**

Desirable characteristics of pavement, types and components, Difference between Highway pavement and Air field pavement, Functions of sub-grade, sub base – Base course – surface course, comparison between Rigid and flexible pavement.

2. Stresses and Deflections in Flexible Pavements **06 hrs**

Factors affecting design and performance of flexible and rigid pavements – Pavement design factors, loads – axle load distribution, ESWL, EWL, VDF due to varying loads and CSA. Application of elastic theory, stresses, deflections / strains in single, two- and three-layer system, Applications in pavement design

3. Flexible Pavement Design **08 hrs**

Flexible pavement design approaches: Empirical, semi- empirical and theoretical design approaches, principle, advantages and application. Design of flexible pavement for low volume and rural roads as per IRC guidelines, outline of other common design methods.

Unit II

4. Stresses in Rigid Pavement **06 hrs**

General design principle, Stresses in rigid pavements, stresses due to wheel loads and temperature variations.

5. Rigid Pavement Design **08 hrs**

Design of cement concrete pavements, white topping as per IRC guidelines. Design features of CRCP, SFRC and ICBP.

Unit III

5. Pavement Failures, Maintenance and Evaluation **08 hrs**

Types of failures, causes, remedial/maintenance measures in flexible pavements – Functional Evaluation by visual inspection and unevenness measurement by using different techniques - Structural Evaluation by Benkelman Beam Deflection Method, Falling weight deflectometer (FWD).

Text Books

1. Khanna S.K., and C.E.G. Justo, & A. Veeraragavan, Highway Engineering, 10th ed., Nem Chand and Bros. Publishers, Roorkee, 2016.
2. Kadiyali.L.R. Principles and Practices of Highway Engineering, 7th ed., Khanna Publishers, New Delhi, 2017.
3. Yoder E.J. and Witczak, 'Principles of pavement design', 2nd ed., John Wiley and Sons, 1975

Reference Books:

1. T. Fwa, 'The Handbook of Highway Engineering', Taylor & Francis Group, Newyork, 2006.
2. Yang H. Huang, "Pavement Analysis and Design", 2nd ed., University of Kentucky, Dorling Kindersley (India) Pvt. Ltd., 2008.
3. IRC: 37-2018 -Guidelines for the Design of Flexible Pavements (Fourth Revision), Indian Roads Congress, New Delhi.
4. IRC: 58-2015- Guidelines for the Design of Plain jointed Rigid pavements for highway, Indian Roads Congress, New Delhi.
5. IRC 81-1997- Guidelines for strengthening of flexible road pavements using Benkelman beam deflection technique, Indian Roads Congress, New Delhi.
6. IRC 59 – 1976- Tentative Guidelines for Design of Gap Graded Cement Concrete Mixes for Road Pavement, Indian Roads Congress, New Delhi.
7. IRC SP: 76- 2015 – Guidelines for conventional and thin white topping (First revision), Indian Road Congress, New Delhi.
8. IRC 101-1988-Guidelines for Design of Continuously Reinforced Concrete Pavement with Elastic Joints, Indian Roads Congress, New Delhi.

Program: Civil Engineering		Semester: VI
Course Title: Applied Hydrology and Hydraulic Structures		Course Code: 18ECVE301
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40	Examination Duration: 3hrs	

Unit I

1. Hydrology and Its Statistics **09 hrs**

Flow duration curves, Stage Discharge Curves, Hydrologic Routing, Risk, reliability, and safety factor, Flood frequency studies; Flood forecasting: Rational method, Time Area curves. Introduction top Water Resources: Basic concepts of systems, need for systems approach in water resources,

2. Reservoir sedimentation: **07 hrs**

Reservoir Design Studies: Area-volume curves, types of reservoirs and zones of storage, storage capacity of reservoirs, Mass curve technique, Reservoir flood routing, sedimentation of reservoirs. Development of storage-yield-reliability
The process of erosion, factors affecting erosion. Trap efficiency and numerical problems. Reservoir sedimentation, life of a reservoir.

Unit II

3. Gravity Dams and Earthen Dams: **07 hrs**

Introduction, forces acting on a gravity dam, types of joints. Stress analysis in gravity dam, design of gravity dam, stability analysis and drainage galleries in gravity dams.
Introduction, types of Earth dams, Design criteria for Earth dams, causes of failure of earth dams, section of dams, preliminary design criteria and problems on it, control of seepage through earth dams.

4. Cross Drainage works and Spillways: **10 hrs**

Types of cross drainage works. Features of design of cross drainage works. Design of siphon aqueduct. Introduction, essentials of a spillway, Energy dissipation below spillways.

Unit III

5. Diversion Head Works: **06 hrs**

Introduction, Khosla's theory, method of independent variables, elements of design for surface flow. Design of vertical drop weir on Bligh's theory. Function of canal head regulator.

Text Books

1. Ven Te Chow, Applied Hydrology – M'c Graw Hill Publications, New Delhi, 2017.
2. Larry W. Mays, Water Resources Engineering - John Wiley & Sons, Inc, Tokyo, 2010
3. Garg S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publications, New Delhi, 2005.
4. Mutreja K.N., Applied Hydrology, McGraw-Hill Book Comp., 1996.
5. Punmia B.C. and Pande Lal, Irrigation and Water Power Engineering, 16ed., Laxhmi Publications, New Delhi, 2009.
6. Sathyanarayana Murthy Challa, Water Resources Engineering, 2ed., New Age International Pvt Ltd Publishers, 2006.

Reference Books:

1. Modi P.N., Irrigation, Water Resources, and Water Power Engineering, Standard Book House, New Delhi, 2004.
2. Madan Mohan Das & Mimi Das Saikia, Irrigation and Water Power Engineering, PHI Learning Pvt. Ltd., New Delhi, 2009.
3. Balasubramanya N., Hydraulic Structures & Irrigation Design Drawing Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2015.

Program: B.E. Civil Engineering		**Semester: VI**
Course Title: Design Studio – Steel and RC Structures		**Course Code: 24ECVP301**
L-T-P: 0-0-3	**Credits: 01**	**Contact Hours: 3 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks:100**
Teaching Hours: 40	**Examination Duration: 3 Hrs**	

Unit I

1. RCC Detailing **20 Hrs**
2. Drawing and detailing of beams (Simply supported and Continuous beam), slab (One way and two way), column, footing (Isolated and combined) and stairs (Dog legged)
3. Retaining walls – cantilever.
4. Water tanks –Overhead (Intz tank), Underground water tank.

Unit II

2. Drawings to be prepared for given structural details **19 Hrs**

1. Connections: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.
2. Columns: Splices, Column-column of same and different sections. Lacing and battens
3. Column Bases: Slab base and gusseted base.
4. Roof Trusses: At supports and different nodes

Text Books

1. Bhavikatti, S.S., *Design of Steel Structures by Limit State of Method – As per IS 800-2007*, I.K. International Publishing House Pvt. Ltd., New Delhi, 2009
2. Ramachandra, *Design of Steel Structures,* Vol- 1 & 2, Standard Book House, New Delhi, 2009.
3. Subramanian, N., *Design of Steel Structures*, Oxford University Press, New Delhi, 2008.
4. Kazimi and Jindal, *Design of Steel Structures*, 2ed., Prentice Hall of India, New Delhi, 2000.

Reference Books:

1. Arya and Ajmani, *Design of Steel Structures*, Nem Chand Bros, Roorkee, 1977
2. Negi L.S., *Design of Steel Structures*, Tata McGraw Hi11 Publishers, 2004

IS Codes:

1. SP 6 (Part 1) Year: 1984 *Handbook for structural engineers - Structural steel sections*
2. SP: 34 Year 1987 *Handbook on Concrete Reinforcement and Detailing*
3. IS:800-2007 *Code of Practice for general Construction in Steel*

Unit III

7. Shock wave and Queueing Analysis **4 hrs**

Introduction to shock waves, Shock wave equation, shockwaves at signalized intersections, along a highway, along a pedestrian-way. Deterministic queueing and stochastic analysis.

8. Traffic simulation models - Calibration and validation **6 hrs**

Fundamentals of Traffic Simulation; Concepts of microscopic models. A basic methodological approach for calibrating and validating a microscopic traffic simulation model. Calibration and validation guidelines. Calibration, validation and data availability. Goodness-of-fit measures. Time series analysis comparisons for the validation. Traffic Simulator: MITSIM, VISSIM; Traffic simulation models for mixed traffic conditions.

Text Books

1. Khanna S.K., and C.E.G. Justo, & A. Veeraragavan, Highway Engineering, 10th ed., Nem Chand and Bros. Publishers, Roorkee, 2016.
2. Kadiyali.L.R L.R., Traffic Engineering and Transportation Planning, 10th ed., Khanna Publishers, New Delhi,2017.
3. May, Adolf D. Traffic Flow Fundamentals. Englewood Cliffs, New Jersey: Prentice-Hall, 1990. ISBN 0139260722.

Reference Books:

1. Matson, T.M., Smith W.S., Hurd, H.W. “Traffic Engineering”, McGraw Hill Book Co.Inc.,New York,2005.
2. Nicholas J Garber & Hoel, “Traffic and Highway Engineering”, 4th ed, 2009.
3. Drew, D.R. “Traffic Flow Theory and Control “, McGraw Hill Book CO.2002
4. Wiiliam R. McShane and Roger P, Roess, “Traffic Engineering”, Prentice Hall, New Jersey,2000.
5. Barceló, J. "Models, Traffic Models, Simulation, and Traffic Simulation". Barceló, J. ed. Fundamentals of traffic simulation. New York: Springer, 2010. P. 1.
6. Papacostas, C.A., “Fundamentals of Transportation Engineering.” Prentice-Hall of India Private Limited, New Delhi,2000.
7. Whol, Martin Traffic Systems Analysis for Engineers and Planners, McGraw Hill, London.
8. IRC SP: 31-1992, New traffic signs’, Indian Roads Congress, New Delhi.
9. IRC 9-1994, Traffic census on Non-Urban Roads (First revision), Indian Roads Congress, New Delhi.
10. IRC 64-1990, Guidelines for capacity of roads in rural areas, Indian Roads Congress, New Delhi.
11. IRC 67-2012, Code of practice for road signs, Indian Roads Congress, New Delhi.
12. IRC 70-1977, Regulation and control of mixed traffic in urban areas, Indian Roads Congress, New Delhi.
13. IRC: 99 – 2018 – Guidelines for traffic calming measures in urban and rural areas, Indian Roads Congress, New Delhi.
14. IRC 93 – 1985, Guidelines on design and installation of road traffic signals, Indian Roads Congress, New Delhi. IRC 124-2017, Bus Rapid Transit (BRT) design guidelines for Indian cities, Indian Roads Congress, New Delhi.
15. IRC: 106- 1990, Guidelines for capacity of urban roads in plain areas, Indian Roads Congress, New Delhi.
16. IRC: SP: 44-1996, Highway safety code, Indian Roads Congress, New Delhi.
17. IRC: 102- 1988- Traffic studies for planning bypasses around town, Indian Roads Congress, New Delhi.

Program: Civil Engineering		Semester: VI
Course Title: Geotechnical Engineering Laboratory		Course Code: 15ECVP304
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 28	Examination Duration: 3hrs	

Exercise

1. Tests for determination of specific gravity and moisture content.
2. Grain size analysis of soil sample.
3. In situ density by core cutter and sand replacement methods.
4. Consistency Limits – Liquid Limit (Casagrande and Cone Penetration Methods), plastic limit and shrinkage limit.
5. Standard Proctor Compaction Test and Modified Proctor Compaction Test.
6. Coefficient of permeability by constant head and variable head methods.
7. Strength Tests

a) Unconfined Compression Test.
b) Direct Shear Test.
c) Triaxial Compression Test (undrained).

8. Consolidation Test- Determination of compression index and coefficient of consolidation.

Demonstration

a) Demonstration of miscellaneous equipment's such as Augers, Samplers, Rapid Moisture meter, Proctor's needle.
b) Demonstration of Hydrometer Test.
c) Demonstration of Free Swell Index and Swell Pressure Test
d) Demonstration of determination of relative density of sands.
e) Laboratory vane shear

Open ended experiment

To use soil as foundation material and construction material.

Reference Books:

1. Braja M. Das., Soil Mechanics Laboratory Manual, 8th edition, Oxford University press, 2015.
2. Lambe T.W., Soil Testing for Engineers, Wiley Eastern Ltd., New Delhi, 1951.
3. Shamsher Prakash and P.K.Jain, Engineering soil testing, Nem Chand and Bros, Roorkee, 2013.
4. IS - SP-36 (Part – 1) -1987 (R 2006) Compendium of Indian standard on soil engineering – Laboratory Testing of Soils for Civil Engineering Purpose.

Program: Civil Engineering		Semester: VI
Course Title: Construction Engineering & Management Laboratory		Course Code: 20ECVP301
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks:100
Teaching Hours: 28 hrs	Examination Duration: 3hrs	

1. Introduction to project management software such as Primavera P6, MS Project, etc.
2. Develop a Work Break-down Structure (WBS) for a residential building of 3 storey.
3. Create and add activities to the WBS and assign relationships as per the logic of the precedence diagram for the residential building. Determine the duration of the project.
4. Apply constraints and filters to the developed activities to develop two-week, one-month and three-month look-ahead schedule.
5. Develop different roles and resources in the resource library and assign to the various activities along with their unit rates.
6. Develop the cost-loaded schedule and create baseline of the project.
7. Perform earned value analysis to track and monitor the project.
8. Building a 3D model of a typical building in AutoCAD Revit 2018 and Synchro (Architectural, Structural and Construction Details)
9. Conduct simulations in Microsoft Visio process simulator to determine most efficient excavation cycles on large scale projects.
10. Conduct Monte-Carlo simulation in Microsoft Excel to perform risk analysis for the project.

Reference Books:

1. Kim Heldman & William Heldman, Microsoft Excel for Project managers 2007.
2. P. Harris, Planning and Scheduling Using Primavera P6 2010.

Program: Civil Engineering		Semester: VI
Course Title: Minor Project		Course Code: 15ECVW302
L-T-P: 0-0-6	Credits: 6	Contact Hours: 12 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 168 hrs	Examination Duration: 3hrs	

Functional and architectural design of a building from, but not restricted to one of the following category: Educational institutions, Administration buildings, Industrial buildings, Commercial buildings, Public facilities such as bus terminus, rail station, hospitals, cinema halls, auditorium etc.

The students shall identify a building for case study and collect data of the building and compare it with HDMC By-laws, NBC-2016 codes and IS codes. Further, students will carry out functional design for their proposed building through bubble diagrams and circulation diagrams and consider aspects such as orientation, aspect, best use of site conditions. The project shall include calculation of loads and analysis and design of components including foundations, columns, beams and slab. Simplified computer aided analysis should be performed.

The student shall submit the following:

- Identification of Project.
- Bubble diagrams and Circulation diagrams
- Logic used to arrive at room dimensions based on ergonomics, furniture sizes and placement, equipment etc.
- Architectural plans, elevations, sections and building services fit for submission to approving authorities
- Preliminary soil investigation.
- Results of structural analysis and design of selected components
- Drawings showing structural details of components designed
- Develop WBS, calculate productivity, create precedence diagram, develop cost-loaded schedule and create a baseline.
- Collection of progress data, update the schedule, perform earned value analysis.

Expected Deliverables:

Identify project details, bubble diagrams and circulation diagrams, complete architectural plans, Soil investigation report, Final structural design drawings and calculations, detailed WBS, productivity calculations, precedence diagram, Initial cost-loaded schedule (Primary Baseline), 1st progress report and earned value report.

Reference Books:

1. IS 1172 – 1971 Code of Basic Requirements for Water Supply, Drainage and Sanitation (Second Rev.), BIS.
2. IS 1642 – 1960 Code of Practice for Fire Safety in Buildings (General): Materials and Constructions in Buildings, BIS.
3. IS 1648 – 1961 Code of Practice for Fire Safety in Buildings (General): Fire fighting Equipment and its maintenance, BIS.
4. IS 1742 – 1972 Code of Practice for Building Drainage, BIS.
5. IS 2065 – 1972 Code of Practice for Water Supply in Buildings (First Rev.) BIS.

6. IS 3861 – 1975 Method of Measurement of Plinth, Carpet and Rentable Area of Buildings(First Rev.) BIS.
7. IS 4326 – 1993 Earthquake Resistant Design and Construction of Buildings – Code of Practice (Second Rev.)
8. IS 7564 – 1974 Recommendations for Co-ordination of Dimensions in Buildings – Arrangement of Building Components.
9. IS:456-2000, Plain and Reinforced Concrete – Code of Practice, BIS, New Delhi, 2000
10. IS:875 (Part 1) - 1987, Code of Practice for Design Loads (Other than Buildings and Structures – Dead Loads, BIS, 1987
11. IS:875 (Part 2) - 1987, Code of Practice for Design Loads (Other than r Buildings and Structures – Live Loads, BIS, 1987.
12. Kraners, Sieverts and Partners. 1977. Open – Plan Offices, UK: McGraw Hill. (English Translation Ritchie, J.L.)
13. Leonard, M. and Cunliffe, R. 1962. Office Buildings, New York: Reinhold
14. National Building Code of India 2016, Bureau of Indian Standards, New Delhi
15. SP:1983 National Building Code of India (First Rev.) BIS.
16.Subramaniyam, T.N. (edited by) n.d. Architects, Engineers and Builders Handbook, Madras: Fairhaven Printers.

Program: Civil Engineering		Semester: VII
Course Title: Pre-Stressed Concrete		Course Code: 24ECVC401
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3hrs	

Unit I

1. Introduction **03 hrs**

Definition, Pre tensioning and Post tensioning, Materials for prestressing, Need of High strength concrete and steel, Stress-strain characteristics and properties. Methods of prestressing

2. Analysis of Sections for Flexure **07 hrs**

Basic principles of prestressing: fundamentals, load balancing concept, stress concept and strength concept. Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles, Pressure line and thrust line.

3. Deflections **05 hrs**

Prediction of short term and long term deflections of un-cracked members.

Unit II

4. Design of Beams **09 hrs**

Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of prestressing force and eccentricity, limiting zone of pre-stressing force cable profile. Analysis of PSC members for shear as per IS 1343-2012.

5. Analysis of Continuous Beam **06 hrs**

Secondary moments in continuous beams, Concordant cable profile for straight and parabolic cable profile.

Unit III

6. Design of End Blocks **05 hrs**

Transmission of pre stress in pre tensioned members, transmission length, Anchorage stress in post- tensioned members. Bearing stress and bearing tensile force-stresses in end blocks-Methods, I.S. Code, provision for the design of end block reinforcement

7. Losses of Prestress **05 hrs**

Various losses encountered in pre- tensioning and post tensioning methods, determination of jacking force.

Text Books

1. Krishna Raju, N, Pre-stressed Concrete, Tata Mc. Graw Publishers, 2012
2. Rajagopalan N, Prestressed Concrete, Narosa book distributers, 2010

Reference Books:

1. Sinha, N .C. & Roy, S.K, Fundamentals of pre-stressed concrete, S Chand publications, 2011
2. Lin, T. Y., and Ned H. Burns, Design of Pre-stressed Concrete Structures, Wiley India Private limited, 2010

3. Dayarathnam, P Sarah, Pre-stressed Concrete structures, Medtech, 2017
4. Ramamrutham, Pre-stressed Concrete, Dhanapatrai Publications, 2017

Program: Civil Engineering		Semester: VII
Course Title: Design of Sub-structures		Course Code: 15ECVE401
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3hrs	

Unit I

1. Soil Exploration **3 hrs**

Subsurface exploration programme for civil engineering projects. Interpretation of soil parameters. Tests on disturbed and undisturbed soil samples, Soil exploration report.

2. Shallow Foundations **6 hrs**

Design Criteria. Types of shallow foundations. Bearing capacity theories. Bearing capacity from field tests. Use of different foundation models. Design of individual and combined footings. Design of raft foundations - Conventional methods. Modulus of subgrade reaction. Beams on elastic foundations. Analysis of footings by Finite Difference.

3. Pile Foundations **6 hrs**

Load carrying capacity of pile. Pile integrity test, Design of pile and pile groups. Batter piles and under reamed piles. Design of pile cap. Design of axially and laterally loaded piles.

Unit II

4. Drilled Piers and Caissons **6 hrs**

Construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

5. Well Foundation **5 hrs**

Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.

6. Foundations on Expansive Soils **5 hrs**

Definition, Identification, Structure, Index properties of expansive soils, Swell potential and Swell pressure, Free swell, CNS layer, foundation treatment for structures in expansive soil.

Unit III

6. Machine Foundations **5 hrs**

Basic terminologies. Design criteria for machine foundations. Vibration analysis. Methods of analysis. Determination of soil parameters. Foundations for reciprocating machines. Foundations for impact type of machines. Vibration isolation.

7. Foundations for Special Structures **4 hrs**

Foundations for tall structures - Water tanks, Chimneys, Antenna towers and Radar units.

Text Books

1. Bowles. J. E, Foundation analysis and design, 5ed, McGraw-Hill Company, Inc, New York, 2012.

2. Das. B.M, Principles of Foundation Engineering, 8ed., Thomson Business Information India (P) Ltd., India, 2014.
3. Murthy V.N.S., Soil Mechanics and Foundation Engineering, 4ed., UBS Publishers and Distributors, New Delhi, 2016.
4. Swami Saran, Analysis and Design of Substructures: Limit State Design, 2ed, oxford and IBH publishing co. Pvt. Ltd., 2006.

Reference Books:

1. Ghosh K.M., Foundation Design in Practice, PHI Learning Pvt. Ltd., New Delhi, 2009.
2. Nainan Kurian., Modern Foundations: An Introduction to Advanced Techniques, Tata McGraw Hill Education Pvt. Ltd, New Dehli, 1982.
3. Prakash, S. and Puri, V.K.., Foundations for Machines: Analysis and design , John Wiley & Sons, New York, 1988.
4. Som N. N., Das S. C., Theory and Practice of Foundation Design, PHI Learning Private Limited, New Delhi, 2009.
5. Srinivasulu, P. and Vaidyanathan, C.V., Hand Book of Machine Foundations, 1ed, Tata McGraw Hill Education Pvt. Ltd, New Dehli , 2002.
6. Tomlinson, M.J., Pile Design and Construction Practice, 6ed, CRC Press, 2014.
7. Winterkorn, H. F. and Fang H. Y., Foundation Engineering Hand Book, 2ed, Van Nostrand Reinhold Company, 1991.
8.Sharat Chandra Gupta, Raft Foundations Design and Analysis with a Practical Approach, New Age International (P) Ltd., Publishers, 1997.

Program: BE Civil Engineering		Semester: VII
Course Title: Finite Element Methods		Course Code: 15ECVE403
L-T-P: 3-0-0	Credits: 03	Contact Hours: 40
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3Hrs	

Unit I

1. Introduction to Finite Element method. **05 Hrs**

Introduction, Basic concepts on finite element analysis, Introduction to nodes, elements, and shape functions, Steps in Finite Element Analysis, Key concepts and Terminologies.

2. Element Properties. **05 Hrs**

Natural Coordinates, Triangular Elements, Rectangular Elements, Introduction to Weighted integrals, Integration by parts-Review, Gradient and Divergence Theorems, Functionals**.**

3. Finite Element Formulation Technique. **05 Hrs**

Virtual Work and Variational Principle (Rayleigh-Ritz Method), Weighted Integrals and Weak Formulation, Different types of weighted integral methods such as Galerkin Method, Petrov-Galerkin Method, Collocation Method and Method of Least-squares

Unit III

4. Second Order Boundary Value Problem. **07 Hrs**

FEA formulation of 2nd order boundary value problem, Development of element level equations, Assembly of element level equations and implementation of boundary conditions, Assembly process and connectivity matrix.

5 Applications of Second Order Boundary Value Problem. **10 Hrs**

Radially symmetric problems, One-dimensional heat transfer problem, Euler-Bernoulli beam, Shear deformable beam, Eigen value problems, Introduction to time dependant problems

Unit III

6. FEM Program **07 Hrs**

Structure of FEM program for FEM Analysis, Description of different modules in FEM software (ABAQUS), Introduction to different types of analysis, Pre and post processing. Comparison of manually solved problems with software results.

Text Books

1. Reddy J.N., *An Introduction to Finite Element Method*, 3ed., McGraw-Hill Publishing Company Inc, New York, 2017.
2. Krishnamoorthy C. S., *Finite Element Analysis*, Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2004.

Design of Underground and Overhead Water Tanks **07 Hrs**

Design of circular and rectangular water tanks resting on ground, underground water tanks and overhead tanks. Assembly of element level equations and implementation of boundary conditions, Assembly process and connectivity matrix.

Text Books:

1. Jain, A.K., *Limit State Method of Design*, 7ed., Nemichand and Bros., Roorkee, 2012.
2. Punmia B.C., Ashok Kumar Jain, and Arun Kumar Jain, *Limit State Design of Reinforced Concrete*, Laxmi Publications Pvt. Ltd., New-Delhi-2016..

Reference Books:

1. Bhavikatti S.S, *Advanced RCC Design (RCC Vol II)*, New Age International Publishers, Tata McGraw Hill Education Pvt Ltd., New-Delhi-2017.
5. P.C.Varghese, Limit State Design of Reinforced Concrete Vol II, Practice Hall of India (P) Ltd, New Delhi.
6. Vazirani V.N & M.M.Ratwani, Analysis of Structures Vol II, Khanna Publishers, New Delhi
7. IS:456-2000, *Plain and Reinforced Concrete – Code of Practice (Fourth Revision)*, BIS, New Delhi, 2000
8. SP 16: *Design Aids for Reinforced Concrete to IS 456:1978*..

Reference Books:

1. Rajasekaran, S., *Finite Element Analysis in Engineering Design*, S. Chand Group, 2006.
2. Pandit G.S. and Gupta S.P., *Structural Analysis, A Matrix Approach*, 2ed., Tata McGraw-Hill, 2008.
3. Cook R.D., Malkus D.S., Plesha M.E. and Witt R.J. *Concepts And Applications Of Finite Element Analysis*, 4ed., Wiley India, 2007.
4. Bathe K.J. *Finite Element Procedures*, Klaus Jürgen Bathe; 2ed., 2014.

Program: BE Civil Engineering		**Semester: VII**
Course Title: Construction Methods		**Course Code: 18ECVE401**
L-T-P: 3-0-0	**Credits: 03**	**Contact Hours: 40**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3Hrs**	

Unit I

1. Planning for earthwork construction. **04 Hrs**

Planning, Graphical presentation of Earthwork, Earthwork quantities, Mass diagram and its applications, Pricing of earthwork operations.

2. Compaction and Stabilization Equipment **05 Hrs**

Compaction of soil and rock, Types of compaction equipment, roller production estimating, Dynamic compaction, Soil stabilization, stabilizing soils with lime, Cement-soil stabilization.

3. Excavators and loaders **06 Hrs**

Hydraulic Excavators, selection of front shovels, calculating shovel production, height of cut effect on shovel production, angle of swing effect on shovel production, Loaders – introduction, Loader buckets/attachments, operating specifications, Loader production rates, calculating wheel loader production, Calculating track loader production, Loader safety

Unit II

4. Drilled Shaft Foundations **05 Hrs**

Introduction, Construction of drilled shafts – dry method of construction, casing method of construction, wet construction method, Installation of casings, Steel cages, Placement of concrete, Dewatering, open dewatering systems, deep well systems, well point systems – Types, techniques, Basement waterproofing systems.

5. Formwork Systems **06 Hrs**

Introduction, formwork materials, shores and scaffolding, Vertical formwork systems – Conventional wall/columns forming systems, Modular panel column form, adjustable wraparound column forms, circular steel forms for round columns, wall panel system, single sided wall formwork, formwork ties, Horizontal formwork systems – conventional wood form and metal systems, cup-lock type scaffolding system, slab flex system, tunnel form, flying formwork system, crane-jumped formwork, automatic climbing formwork, self-rising core system, Monolithic Formwork System.

6. Concrete and Conveying Systems **06 Hrs**

Introduction, Concrete – Mixers, Concrete plants, Pre-tensioning and Post tensioning, Transporting and handling – Concrete chute, concrete mixer with lift, concrete skip, truck mixer concrete pumps, concrete belt conveyors, concrete pump truck, trailer pump and pipeline with

tower-mounted boom, trailer mounted pumps, pipeline system, mobile concrete placing booms, finishing.

Unit III

7. Cranes **05 Hrs**

Major cranes types, Mobile cranes, Crawler cranes, Telescoping-boom truck-mounted cranes, Lattice-boom truck-mounted cranes, Rough-terrain cranes, modified cranes for heavy lifting, crane booms, lifting capacities of cranes, Rated loads for lattice and telescopic boom cranes, Tower cranes – classifications, operation, Tower crane selection, Rated loads for tower cranes, rigging, slings, safety.

8. Modular Construction Practices: **03 Hrs**

Introduction to Modular Construction, Modular coordination, Modular Standardization, Modular System Building, Limitation and Advantages of Modular Construction

Text Books

1. S. C. Sharma, *Construction Equipment and Management,* Khanna Book Publications,2016
2. Peurifoy, *Construction Planning, Equipment & Method,* 7ed., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
3. Basem M*, Construction Technology for High-rise Buildings-Handbook*, 2014

Reference Books:

1. Stephens W. Nunnally, *Managing Construction Equipment*, 2ed, Pearson Publications, USA, 2000.
2. Gupta B. L., Amit Gupta, *Construction Management and Machinary*, 5ed, Standard Publications, New Delhi, 2015...

Program: BE Civil Engineering		Semester: VII
Course Title: Advanced Project Management		Course Code: 22ECVE401
L-T-P: 3-0-0	Credits: 03	Contact Hours: 40
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3Hrs	

Unit I

1. Operation Research in Management **10 Hrs**

Introduction, definition, phases, scope, characteristics, limitations of operational research, and management decision making. Methodology and applications of operational research. Linear programming, applications, formulations of LP models. Graphical methods, Simplex method, Transportation Models-Balanced & Un-balanced type of problems

2. Cost Control **05 Hrs**

Introduction, project costs – direct and indirect, cost optimization through networks, use of simplex and dual simplex methods of linear programming to optimize construction costs, project cost formulation.

Unit II

3. Construction Site Layout **05 Hrs**

Introduction, Objectives of preparing a site layout, Factors affecting the site layout, documentation study before site layout, Storing and stacking of materials on site, Location of machinery and equipment, Stack size of common building materials, Preparation of a site layout.

4. Construction Disputes and their Settlements **05 Hrs**

Introduction, development of disputes, types of disputes, modes of settlements, settlement by direct negotiations between the client and contractor, settlement through arbitration, arbitration act 1940, powers of an arbitrator as per 1940 act, settlement through courts.

5. Risks and Insurance in Construction **05 Hrs**

Introduction, risk, risk identification in construction, risk analysis and evaluation process, response management process, insurance in construction, principles of insurance, project insurance, contractor's all risk insurance, fire policy, plant and machinery insurance, liquidity damages insurance, professional indemnity policy.

Unit III

6. Construction Safety Management **05 Hrs**

Introduction, evolution of safety, Accident causation theories, unsafe conditions and acts, health and safety act and regulations, role of safety personal, causes of accidents, principles of safety, safety and health management system.

7. Construction Labour and relevant Laws **05 Hrs**

Introduction, construction labour in India, payment of wages to labour, Labour Laws, payment of wages act 1936, minimum wages act 1948, workers compensation act 1923, contract labor

act 1970, employees state insurance act 1948, bonus act, employee's provident fund act, trade unions and their role.

Text Books

1. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, 2ed., Edition, Pearson Publications, 2015.
2. S.C. Sharma, *Construction equipment and management,* new edition, 2019
3. P. Rama Murty, Operations Research, 2nd edition, 2007, New age international publishers

Reference Books:

1. P. Harris, *Planning and Scheduling Using MS Project* 2010*.*
2. Ursula Kuehn, *Integrated Cost and Schedule Control in Project Management,* 2ed.,2011…

Program: BE Civil Engineering		Semester: VII
Course Title: Construction Contract Management		Course Code:23ECVE401
L-T-P: 3-0-0	Credits: 3	Contact Hours:3
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:40 hrs	Examination Duration: 3	

Unit I

1. **Introduction to Contracts** **07 Hrs**

Introduction to Contracts, Parts of contracts, Importance of contract, Essential elements of valid contracts, Important conditions of contracts, Development of a project, Characteristics of a good contract, legal enforceability of contract, Breach & termination of contract, Major stack holders in contracts

2. Construction Contracts **08 Hrs**

Types of contracts: Lump sum contracts, Fixed price contracts, Percentage rate contracts, Cost Plus contract, Target contracts, Design build contracts, Turn Key contract, BOT contracts, Roles and functions of parties to the contract, Formation of contract, Contract duration & price. Contract formats: FIDIC, CPWD, Special condition of contracts (SCC), PWD procedure of execution a project.

Unit II

3. Tenders **05 Hrs**

Process of tendering, Tender notice, EOI, RFQ & RFP, bid security, prequalification process, bidding models & bidding strategy, Tender submission & evaluation, Tender rejection, security deposits/performance guarantee & defect liability, Contract agreement & contract document. Performance parameter: Delays, Penalties & Liquidated damages, Force majeure, Suspension & termination.

4. Conditions of Contract **05 Hrs**

General conditions & special condition of contracts, contract condition for payments, Time delays, Scope changes, Extra claims, Termination of contract, Liquidated damages & bonus for early completion, Subletting, Breach of contracts, Arbitration, Settlement of accounts & final payment.

5. Specifications **05 Hrs**

Purpose of specifications, Types of specifications, Importance of specifications. Writing of specifications, Specifications for excavation, concrete materials, reinforcement, brickwork, cement plaster, doors windows & ventilators.

Unit III

6. Procurement & risk allocation **05 Hrs**

Type of risk in construction contracts, dealing with risk, allocating risk through methods of payment, Procurement criteria, Identifying and choosing procurement methods

7. Management contracting **05 Hrs**

Contractual relationship in management contracting, Use of management contracting, Principles of management contracting, risk in management contracting, approach to management contracting.

Reference Books:

1. Explanation of Indian Contract Act: Mulla and Sanjeeva Rao, B. D. Virmani, B.T. Gajaria
2. Construction contracting, Clough Richarch, John Wiley & Sons, New York, 1986
3. Construction Contract Management, Prakash V. A., NICMAR, BOMBAY
4. V.K. Raina, Raina's Construction and Contract Management Vol. 1 (2nd edition), SPD publishers, 2009.
5. Patil B. S. " Building and Engineering Contracts
6. Handbook of contracts: Hudson
7. Patil B. S.,(2009) "Civil Engineering Contracts and Estimates", University Press.

Program: BE Civil Engineering		Semester: VII
Course Title: Solid Waste Management		Course Code: 15ECVE407
L-T-P: 3-0-0	Credits: 03	Contact Hours: 40
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3Hrs	

Unit I

1. Introduction **05 Hrs**

Solid waste -Definition, Land Pollution -scope and importance of solid waste management, functional elements of solid waste management. SOURCES: Classification and characteristics-municipal, hospital / biomedical waste, Quantity -Generation rate, methods. Latest Trends in SWM: (1) Legacy wastes and landfill mining: Risks and Rewards (2) Centralized and decentralized SWM approach in Villages, ULBs and Metro cities: Pros and Cons.

2. Collection and Transportation **05 Hrs**

Systems of collection, collection equipment, garbage chutes, transfer stations -bailing and compacting, route optimization

3. Processing Techniques **05 Hrs**

Components separation, volume reduction, size reduction, chemical reduction and biological processing**.**

Unit II

4. Disposal Methods **07 Hrs**

Factors affecting disposal methods, Selection of site, Open dumping, ocean disposal, Incineration processes, Pyrolysis, Composting- Aerobic and anaerobic composting, Indore and Bangalore processes, Vermi composting.

5. Sanitary Land Filling **08 Hrs**

Methods-Trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate collection and control methods, gas collection systems. .

Unit III

6. Biomedical waste management **05 Hrs**

Types of wastes, sources of biomedical waste, Categories and classification of biomedical waste, hazard of bio medical waste, waste minimization, treatment and disposal. The Biomedical Waste Management & Handling) Rules, 2016.

7.Hazardous waste management **05 Hrs**

Source, generation rates, characteristics of hazardous wastes and their regulation, handling, treatment and disposal. Hazardous Waste (Management and Handling) Rules, 2016.

Program: BE Civil Engineering		**Semester: VII**
Course Title: Advanced Waste Water Treatment		**Course Code: 15ECVE408**
L-T-P: 3-0-0	**Credits: 03**	**Contact Hours: 40**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3Hrs**	

Unit I

1.Introduction **03 Hrs**

Wastewater Characteristics, Effluent Quality Standards, Receiving Stream Quality

2. Primary Treatment **06 Hrs**

Screening, Grit removal, Neutralization, equalization, Sedimentation, Flotation (oil & grease removal)

3. Secondary Treatment **06 Hrs**

Fundamental concept of reactors: Mass balance relationships, analysis and descriptions of reactors- batch, completely mixed flow and plug flow oxygen requirement in aerobic process

Unit II

4. Biological Treatment **10 Hrs**

Activated Sludge Process: Substrate Utilization and Biomass Growth, Kinetic Parameters, Process Description and its Modification, Process Design, Biofilm Process: Constructed Wetlands/Natural Treatment Systems, Sequencing Batch Reactor(SBR), Moving Bed Bio film Reactor(MBBR), Aerated lagoons.

5.Advanced Treatment Processes- - **06 Hrs**

Chemical Coagulation, Carbon Adsorption, Phosphorus Removal, Nitrogen Removal (Nitrification/Denitrification), Media Filtration, UV Disinfection

Unit III

6. Solids Handling Processes 09 Hrs

Gravity Thickening, Flotation Thickening, Dewatering, Pressure Filtration, Stabilization, Aerobic and Anaerobic Digestion, Composting, Drying, Incineration, Landfilling, Land Application

Text Books

1. Eddy and Metcalf ,*Wastewater Engineering – Treatment and Reuse* ,Tata McGraw Hill Education Pvt Ltd., New Delhi, 2003.
2. Modi, P.N., *Sewage Treatment and Disposal Engg.*, Standard Book House, New Delhi, 2000.
3. Howard S. Peavy, Donald R. Rowe, George Techno Bano Glous, *Environmental Engineering*, McGraw Hill International, 2010

Reference Books:

1. Qasim S.R., Motley E. M., *Wastewater Treatment Plants – Planning, Design and Operation*, Prentice Hall, New Delhi. 2002.

2. Davis, M.L. and Cornwell, D.A., *Introduction to Environmental Engineering*, Tata McGraw Hill Education Pvt. Ltd., New Delhi,. 2010
3. Hammer M.J., *Water and Waste Water Technology*, John Wiley and Sons, New York , 2000.

Program: BE Civil Engineering		Semester: VII
Course Title: Air Pollution		Course Code: 15ECVE409
L-T-P: 3-0-0	Credits: 03	Contact Hours: 40
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40 hrs	Examination Duration: 3Hrs	

Unit I

1. Introduction **06 Hrs**

Definition -Classification and properties of Air pollutants, Primary and secondary Air pollutants, Concentrations of Air pollutants and sources. Behavior and Fate of Air Pollution: Chemical reaction in the Atmosphere, photochemical Smog. Air Pollution due to Automobiles.

2. Effects of Air Pollution **04 Hrs**

On human health, Animals, Plant and properties, Major Episodes- Case Studies.
Global Environmental Issues- Acid Rain, Green House Effect, Global warming, Ozone layer depletion.

3. Meteorology **05 Hrs**

Introduction -Meteorological Variables, Lapse Rate – Adiabatic -Dispersion, inversion, stability conditions, wind rose, general characteristics of stack plumes

Unit II

4. Sampling and Analysis of Air Pollutants **05 Hrs**

Sampling and measurement of Gaseous and particulate pollutants, stack sampling, smoke and its measurements.

5. Control of Air Pollutants **10 Hrs**

Control methods -Particulate emission control, design of gravitational settling chambers, design of cyclone separators, fabric filters, Electrostatic precipitators, wet scrubbers, control of gaseous emissions.

Unit III

6. Environmental Impact Assessment **10 Hrs**

Environmental Impact Assessment in industrial plant locations and planning. Standards and legislation -Air quality and emission standards-legislation and regulation, Air pollution index, EIA Case Study-Mining. Introduction to Air Quality Modelling.

Text Books

1. Rao, H.V.N., and Rao, M.N., *Air Pollution*, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2007.

2. Rao, C.S., *Environmental Pollution Control*, New Age International Pvt. Ltd, New Delhi, 2006

Reference Books:

2. Henry C Perkins, *Air pollution*, Tata McGraw Hill Education Pvt Ltd., New Delhi, 1974

Program: BE Civil Engineering		**Semester: VII**
Course Title: Nano Composite Materials		**Course Code: 15ECVO401**
L-T-P: 3-0-0	**Credits: 03**	**Contact Hours: 40**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3Hrs**	

Unit I

1.Introduction **06 Hrs**

Introduction to materials, traditional materials, development, properties, strength of and mechanical properties of materials , introduction, definition, classification and characteristics of composite materials - fibrous composites, laminated composites, particulate composites

2.Fiber and matrices **05 Hrs**

Carbon fibers, glass fibers, silicon carbide and organic fibers. Polymer matrices, metal matrices and ceramic matrices.

3.Fabrication and application **05 Hrs**

Polymer composites, metal composites and ceramic composites Application of composites: Automobile, Aircrafts, missiles, Space hardware, Electrical and electronics, marine, recreational and Sports equipment, future potential of composites

Unit II

4. An overview of Nanoscience & Nanotechnology **06 Hrs**

Historical background – nature, scope and content of the subject – multidisciplinary aspects – industrial, economic and societal implications.

5.Experimental Techniques and Methods **05 Hrs**

For investigating and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes

6.Introduction to Nanomaterials **05 Hrs**

Carbon Nanotubes , synthesis and purification – filling of nanotubes – mechanism of growth – electronic structure – transport properties – mechanical and physical properties – applications

Unit III

7.Introduction to nano-composite

Nano composite polymer matrix, nano composite ceramic matrix, nano composite metal matrix Applications in engineering, future scope of nano-composite, research, training in development of nano-composite materials.

8.Safety and environmental aspects

Safety and environmental aspects of nano-materials, future challenge, cost optimization and fabrication process of nano composite materials

Text Books

1. Hull D. and Clyne T.W., *Introduction to Composite Materials*, Cambridge University Press, 2nd edition, 1996.
2. Pradeep T., *NANO: The Essentials – Understanding Nanoscience and Nanotechnology,* 1ed., Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2017

Reference Books:

1. Ventra M.,Evoy S., Heflin J.R., *Introduction to Nanoscale Science and Technology [Series: Nanostructure Science and Technology],* Springer (2006).
2. Chawla K.K., *Composite Material : Science and Engineering*, 3ed., Springer, 2012.
3. Linda Williams & Wade Adams *Nanotechnology Demystified,* McGraw-Hill Company Inc, New York, 2007.
4. Johns R.M., *Mechanics of Composite Materials*, 2ed., CRC Press, 2015

Program: BE Civil Engineering		Semester: VII
Course Title: Optimization Techniques		**Course Code: 15ECVO402**
L-T-P: 3-0-0	**Credits: 03**	**Contact Hours: 40**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:100**
Teaching Hours: 40 hrs	**Examination Duration: 3Hrs**	

Unit I

1. Introduction **04 Hrs**

Engineering applications, optimum design methods, Mathematical statement, Terminology and basic concepts, Classification of optimization problems, Optimization Techniques.

2. Classical Optimization Techniques **05 Hrs**

Single variable optimization, Multivariable optimization without constraints, Multivariable optimization with constraints -Lagrange multiplier method and constrained variation method – Kuhntucker conditions.

3. Linear Programming **05 Hrs**

Standard form LP, Geometry and solution of LP , Pivotal reduction Simplex method, two phase simplex method, revised simplex method

Unit II

4. Non-linear Unconstrained Optimization Search Techniques **08 Hrs**

One dimensional problems, Elimination Methods - Fibonacci Method, Dichotomous Search, Golden Section Method, Interpolation methods - Quadratic Interpolation Method – Quadratic Interpolation Method, Direct Root Methods, Direct search method- Powell Flether method, Hooke and Jeeve's method, Descent methods.

5. Non-linear Constrained Optimization Search Techniques **08 Hrs**

Direct Methods - Feasible Direction method, sequential linear programming techniques Indirect Method - Interior and Exterior penalty function method.

Unit III

6. Geometric Programming **06 Hrs**

Posynomial, Unconstrained Minimization Problem by Differential Calculus, Constrained Minimization using Geometric Programming,

7. Dynamic Programming **04 Hrs**

Multistage decision concert, principles of optimality.

Text Books

1. Rao S.S., *Engineering Optimization Theory and Application*, 3ed.,New Age International Pvt. Ltd., New Delhi, 2013.

2. Bhavikatti, S.S., *Fundamentals of Optimum Designs in Engineering*, 1ed., New Age Publishers, New Delhi, 2017.
3. Ravindran A, Ragsdel K.M., Reklaitis G.V., *Engineering Optimization: Methods and Applications*, 2ed., Wiley India Pvt. Ltd., 2006.
4. Rudra Pratap, *Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers*, Oxford Uni Press, 2010.

Reference Books:

1. Belegundu A., Chandrupatla T.R., *Optimization Concepts and Applications in Engineering*", 2ed., Cambridge University Press, 2011
2. Bishma Rao GSS, *Optimization Techniques*, Scitech Publication., 2003.
3. Mohan C. and Kusum Deep, *Optimization Techniques*, 1ed., New Age International Pvt. Ltd., New Delhi, 2009.