Dr. YSR Architecture and Fine Arts University

School of Planning and Architecture (**SPA**)

B. Tech in

Construction Technology & Management (CTM)

R21

Course Structure and Syllabus

DEPARTMENT OF CONSTRUCTION TECHNOLOGY & MANAGEMENT

Vision

To become a school of excellence that brings out construction engineers with high technical competencies and promotes high-end research to meet the current and future challenges in Construction Technology & Management.

Mission

- To offer Under-Graduate program in Construction Technology & Management and other skill development courses that add value to student competencies.
- To promote quality education, research and consultancy for industrial and societal needs.
- To inculcate moral and ethical values among the students.
- To impart knowledge with emphasis on the development of leadership qualities in students.
- To provide state-of-the-art resources that contributes to a congenial learning environment.
- To encourage students to pursue higher education and take competitive exams and various career enhancing courses.
- To establish centres of excellence in emerging areas of research.
- To have regular interaction with industry and offer solutions to their problems.

Program Educational Objectives (PEOs)

PEO 1: Practice engineering in a broad range of industrial, societal and real-world applications.

PEO 2: Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.

PEO 3: Conduct themselves in a responsible, professional, and ethical manner.

PEO 4: Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.

Programme Outcomes (POs)

1. **Technical and management knowledge**: An ability to apply knowledge of science, Engineering, technology and management to the solution of complex problems.
2. **Problem analysis:** An ability to identify, formulate, review and analyze and solve complex built environment problems.
3. **Design & development of solutions:** An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

4. **Analysis, Design and Research:** An ability to design and conduct experiments, as well as to analyze and interpret data.
5. **Modern tool usage:** An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
6. **The society and culture:** Contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Built environment sector.
7. **Environment and sustainability:** The broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Correlation between the POs and the PEOs

PEOs	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
I	✓	✓	✓	✓								
II			✓	✓	✓	✓	✓	✓				
III								✓	✓	✓	✓	
IV							✓					✓

Program Specific Outcomes (PSOs):

PSO1: Acquire Knowledge on construction materials, apply the concepts of analysis and investigation using modern tools to design Engineering structures.

PSO2: Ability to understand and apply advanced technologies for real life engineering problems using software tools to analyze, plan, design, and implement solutions.

PSO3: Ability to apply project management principles, Legal and contractual aspects to real time projects for efficient execution of construction projects.

PSO4: Ability to manage Material, Money and Man power efficiently for execution of construction projects.

COURSE STRUCTURE

SEMESTER I

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	General /Basic Science Courses										
1	CC21B1G1	Mathematics-I	3	1	0	4	4	50	50	100	W
2	CT21B1G2	Engineering Physics	4	0	0	4	4	50	50	100	W
3	CT21B1G3	Basics of Electrical & Electronics Engineering	4	0	0	4	4	50	50	100	W
4	CT21B1G4	Introduction to Construction Management	4	0	0	4	4	50	50	100	W
	Ability Enhancement Course										
5	CT21B1A1	Innovation and Design Thinking	4	0	0	4	4	50	50	100	W
	Laboratories/Studios/Practical										
6	CT21B1P1	Basic Computer Applications Laboratory	0	0	3	3	3	50	50	100	P
7	CT21B1P2	Communication Skills Laboratory	0	0	3	3	3	50	50	100	P
8	CT21B1P3	Engineering Graphics	1	0	3	4	4	50	50	100	P
	Mandatory Course (AICTE)										
9	MC21B101	UHV-1	2	0	0	2	0	-	-	-	-
		Total	**22**	**1**	**9**	**32**	**30**				

SEMESTER II

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	General /Basic Science Courses										
1	CC21B2G1	Environmental Chemistry	4	0	0	4	4	50	50	100	W
	Professional Core Theory										
2	CT21B2C1	Engineering Mechanics	3	1	0	4	4	50	50	100	W
3	CT21B2C2	Building Materials	4	0	0	4	4	50	50	100	W
4	CT21B2C3	Building Planning and Drawing	2	2	0	4	4	50	50	100	W
5	CT21B2C4	Operational Research Methods	4	0	0	4	4	50	50	100	W
	Ability Enhancement Course										
6	CT21B2A1	Basics of Entrepreneurship	3	0	0	3	3	50	50	100	W
	Laboratories/Studios/Practical										
7	CT21B2P1	Programming for Problem Solving	1	0	3	4	4	50	50	100	P
8	CT21B2S1	Construction Material and Practices Studio	0	0	3	3	3	50	50	100	J
	Mandatory Course (AICTE)										
9	MC21B201	Environmental Studies	2	0	0	2	0	-	-	-	-
		Total	**22**	**4**	**6**	**32**	**30**				

SEMESTER III

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	Professional Core Theory										
1	CT21B3C1	Surveying & Geomatics	4	0	0	4	4	50	50	100	W
2	CT21B3C2	Fluid Mechanics & Hydraulic Machines	3	1	0	4	4	50	50	100	W
3	CT21B3C3	Strength of Materials	3	1	0	4	4	50	50	100	W
4	CT21B3C4	Remote sensing and GIS	3	0	0	3	3	50	50	100	W
5	CT21B3C5	Advanced Construction Techniques	3	0	0	3	3	50	50	100	W
6	CT21B3C6	Construction Planning and Management	4	0	0	4	4	50	50	100	W
	Core Laboratory										
7	CT21B3P1	Construction Materials Testing Laboratory	0	0	3	3	3	50	50	100	P
8	CT21B3P2	Surveying Laboratory	0	0	3	3	3	50	50	100	P
	Skill Enhancement Course										
9	CT21B3K1	**Skill/Job Oriented Course-01 -** Construction Site Visit	0	2	0	2	2	100	-	100	P
	Mandatory Course(AICTE)										
10	MC21B301	Indian Constitution	2	0	0	2	0	-	-	-	-
		Total	**22**	**4**	**6**	**32**	**30**				

SEMESTER IV

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	Professional Core Theory										
1	CT21B4C1	Structural Analysis	3	1	0	4	4	50	50	100	W
2	CT21B4C2	Transportation Engineering	3	0	0	3	3	50	50	100	W
3	CT21B4C3	Building Services	3	0	0	3	3	50	50	100	W
4	CT21B4C4	Construction Economics and Finance	3	0	0	3	3	50	50	100	W
5	CT21B4C5	Advanced Concrete Technology	3	0	0	3	3	50	50	100	W
	Professional Elective - 01										
6	CT21B4E1	Environmental Engineering	3	0	0	3	3	50	50	100	W
	CT21B4E2	Architecture and Town planning									
	CT21B4E3	Water resources systems: Modelling and Analysis									
7	**Open Elective - 01**										
	CT21B4O1	Engineering Geology	2	0	0	2	2	100	-	100	-
	Core Laboratory										
8	CT21B4P1	Transportation Engineering Laboratory	0	0	3	3	3	50	50	100	P
9	CT21B4P2	Advanced Concrete Technology Laboratory	0	0	3	3	3	50	50	100	P
	Skill Enhancement Course										
10	CT21B4K1	**Skill/Job Oriented Course-02** - Soft skills and Advanced communication skills	0	2	0	2	2	100	-	100	P
11	CT21B4TS	Technical Seminar	0	2	0	2	1	100	-	100	P
	Mandatory Course (AICTE)										
12	MC21B401	Essence of Indian Traditional Knowledge	2	0	0	2	0	-	-	-	-
	*Mandatory Community Service Project during summer vacation between IV and V semester and evaluation will be done as per the guidelines given by APSCHE										
		Total	**22**	**5**	**6**	**33**	**30**				

*** Credits will be allotted in V semester**

SEMESTER V

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	Professional Core Theory										
1	CT21B5C1	Design of Reinforced Concrete Structures	3	2	0	5	4	50	50	100	W
2	CT21B5C2	Estimation & Quantity Surveying	3	0	0	3	3	50	50	100	W
3	CT21B5C3	Quality and Safety Management in Construction	3	0	0	3	3	50	50	100	W
4	CT21B5C4	Geotechnical Engineering	3	0	0	3	3	50	50	100	W
	Professional Elective - 02										
5	CT21B5E1	High Rise Buildings	3	0	0	3	3	50	50	100	W
	CT21B5E2	Low-Cost Construction Techniques									
	CT21B5E3	Ground Improvement Techniques									
	Open Elective - 02										
6	CT21B5O1	Water Harvesting And Conservation	2	0	0	2	2	100	-	100	-
	Core Laboratory										
7	CT21B5P1	Geotechnical Engineering Laboratory	0	0	3	3	3	50	50	100	P
8	CT21B5S1	Quantity Estimation and Construction Practices Studio	0	0	3	3	3	50	50	100	J
	Skill Enhancement Course										
9	CT21B5K1	**Skill/Job Oriented Course-03** - Python Programming	0	2	0	2	2	100	-	100	P
10	GN21B5CSP	Community Service Project	(During Vacation) 180 hours				4*	100	-	100	P
		Total	**17**	**4**	**6**	**27**	**30**				

*Credits for Mandatory Community Service Project during summer vacation between V semester and VI semester

SEMESTER VI

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	Professional Core Theory										
1	CT21B6C1	Construction Material and Equipment Management	4	0	0	4	4	50	50	100	W
2	CT21B6C2	Green Building Technologies	3	0	0	3	3	50	50	100	W
3	CT21B6C3	Prestressed and Prefabricated Structures	4	0	0	4	4	50	50	100	W
4	CT21B6C4	Design of Steel Structures	3	1	0	4	4	50	50	100	W
	Professional Elective - 03										
5	CT21B6E1	Infrastructure Planning and Management	4	0	0	4	4	50	50	100	W
	CT21B6E2	Design of Bridges									
	CT21B6E3	Advanced Reinforced concrete Structures									
	Open Elective - 03										
6	CT21B6O1	Environmental Pollution and control	2	0	0	2	2	100	-	100	-
	Core Laboratory										
7	CT21B6P1	Computer Aided Building Planning & Design Laboratory	0	0	3	3	3	50	50	100	P
8	CT21B6P2	Construction Project Management Software laboratory	0	0	3	3	3	50	50	100	P
	Skill Enhancement Course										
9	CT21B6K1	**Skill/Job Oriented Course-04** - Google SketchUp software	0	2	0	2	2	100	-	100	P
10	CT21B6TS	Technical Seminar	0	2	0	2	1	100	-	100	P
	*Industrial / Research Internship (CT21B7IN) mandatory after VI Semester. Evaluation will be done as per the guidelines given by APSCHE										
		Total	**20**	**5**	**6**	**31**	**30**				

Note: W- Written, P- Practical (all practical exams will be followed by viva – voce.

* Credits will be allotted in VII semester.

SEMESTER VII

S.No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P/S	Total		Int	Ext	Total	W/P/J
	Professional Core Theory										
1	CT21B7C1	Construction Accounts and Financial management	4	0	0	4	4	50	50	100	W
2	CT21B7C2	Construction Contracts & Specifications	3	0	0	3	3	50	50	100	W
3	CT21B7C3	Risk Management in construction	3	0	0	3	3	50	50	100	W
	Professional Elective - 04										
4	CT21B7E1	Repair, Rehabilitation and Retrofitting of Concrete Structures	3	0	0	3	3	50	50	100	W
	CT21B7E2	Earthquake Resistant Design and Construction									
	CT21B7E3	Urban Transportation Planning									
	Professional Elective - 05										
5	CT21B7E4	Lean construction Techniques	3	0	0	3	3	50	50	100	W
	CT21B7E5	Climate Change and sustainable development									
	CT21B7E6	Research methodology & IPR									
	Open Elective - 04										
6	CT21B7O1	Disaster Management and Mitigation	2	0	0	2	2	100	-	100	-
	Core Laboratory										
7	CT21B7P1	Building Information Modelling Laboratory	0	0	3	3	3	50	50	100	P
8	CT21B7P2	Navisworks Laboratory	0	0	3	3	3	50	50	100	P
	Skill Enhancement Course										
9	CT21B7K1	**Skill/Job Oriented Course-05** - MOOC'S	0	2	0	2	2	100	-	100	P
10	CT21B7IN	Industrial / Research Internship	Vacation (180 hours)				4 *				
		Total	**18**	**2**	**6**	**26**	**30**				

Note: W- Written, P- Practical (all practical exams will be followed by viva – voce).

***Credits for Industrial Internship carried out during summer vacation between VI and VII semesters.**

SEMESTER VIII

S. No	Course Code	Course Title	Periods per Week				Credits	Marks			End Exam
			L	T	P	Total		Int	Ext	Total	W/P/J
1	CT21B8PT	Industrial Mini project / Internship	540 Hours				12*	50	150	200	J
2	CT21B8PW	Project Work					18	100	100	200	J
		Total	**0**	**0**	**0**	**0**	**30**				

P- Practical

***Mandatory Internship done during current semester can be extended as major project.**

Note:

- The evaluation of the Industrial Internship or on the job training will be done as per the guidelines given by APSCHE**.**
- **Open Electives** in **IV, V, VI and VII Semesters** can be selected by the students based on the Subject pool list provided within that semester by academic regulations committee concerned.

SYLLABUS

SEMESTER – I

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
I	CC21B1G1	Mathematics-I	3	1	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Identify special properties of a matrix, such as eigen values, Eigen vectors, etc., and use this information to facilitate the calculation of matrix characteristics.	2, 4	2, 3
CO2	To gain knowledge on various properties of quadratic forms of matrices.	2, 4	2, 3
CO3	To Analyze and acquire knowledge of functions by using various mean value theorems.	2, 4	2, 3
CO4	To Analyze and acquire knowledge on differential equations of first order first degree.	2, 4	2, 3
CO5	To understand the Properties of multivariable calculus and vector Differentiation.	2, 4	2, 3
CO6	To understand the solutions for various Partial differential equations and Properties of curves of best fit to the given data.	2, 4	2, 3

MODULE – I

Matrices: Rank of a matrix by echelon form, Normal form, solving system of homogeneous and non-homogeneous linear equations, Eigen values and Eigen vectors and their properties. Cayley-Hamilton theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton theorem.

MODULE – II

Quadratic forms of matrices: Diagonalization of a matrix, Symmetric, Skew – Symmetric, Orthogonal, Hermitian, Skew Hermitian and unitary matrices and their properties. Quadratic forms and nature of the quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE – III

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

MODULE – IV

Differential equations of first order and first degree: Differential equations of first order and first degree – Exact, linear and Bernoulli equations. Applications to Newton's law of cooling, law of natural growth and decay.

MODULE – V
Multivariable Calculus: Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence. **Vector differentiation:** Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.
MODULE – VI
Partial Differential Equations: Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method. **Curve fitting:** Fitting a straight line – Second degree curve –Exponential curve-Power curve by method of least squares. Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 Rule Simpson's 3/8 Rule.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
3. A Text Book of Engineering Mathematics, Vol – 1, T.K.V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
4. A Text Book of Engineering Mathematics, Vol–II, T. K. V. Iyengar, B. Krishna Gandhi and Others S. Chand & Company.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers,2013.
4. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
5. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
6. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1G2	Engineering Physics	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Analyze the differences between interference and diffraction with applications.	1, 2	2, 3
CO2	To understand the response of magnetic materials and super conductors to the various fields of applications.	1	2, 3
CO3	To Apply the principles of acoustics for noise level reductions.	1, 4	2, 3
CO4	To understand the properties of ultrasonics, methods and applications.	1, 5	2, 3
CO5	To acquire knowledge on different production methods of lasers and their applications in engineering.	1, 2	2, 3
CO6	To know the principle of optical fibres & applications and apply the basic properties of nanomaterials in various Engineering applications.	1, 2	2, 3

MODULE – I

Wave Optics

Interference: Principle of superposition – Interference of light – Interference in thin films (Reflection Geometry) & applications – Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.

Diffraction: Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit – N-slits (Qualitative) – Grating spectrum.

MODULE – II

Magnetic and Superconducting Materials: Classification of magnetic materials (Dia, para, Ferro, Ferri, Anti Ferro materials (Qualitative) Types of Superconductors, BCS Theory, High Temperature Superconductors, and their applications.

MODULE – III

Acoustics of Buildings: Introduction – classification of sound, sound intensity level (decibel), Requirements of acoustically good hall, Reverberation and Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

MODULE – IV

Ultrasonic: Properties of ultrasonic, types of ultrasonic waves, production of ultrasonic by piezoelectric and magnetostriction methods. Non-Destructive Testing – Pulse echo system through transmission and reflection modes – Applications.

MODULE – V
Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.
MODULE – VI
Fiber optics - Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (Qualitative) – Applications. **Nanomaterials -** Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Text Books:

1. M. N. Avadhanulu, P. G. Khirsagar, and T. V. S. Arun Murthy, A textbook of Engineering Physics, Revised edition (11e), S. Chand and Company Ltd., 2019.
2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.
3. I. R. Sinclair, Sensor and Transducers, 3rd Edition, Elsevier (Newnes), 2001.
4. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017

Reference Books:

1. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
4. Engineering Physics – M.R. Srinivasan, New Age Publications
5. P.K Palaniswamy, *Engineering Physics*, SCITECH Publications (India) Pvt. Ltd
6. A. P. French, Vibration's and Waves, CRC Press, 2003

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1G3	Basics of Electrical & Electronics Engineering	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain knowledge regarding the basics of DC and AC circuits.	1, 2	2, 3
CO2	To gain knowledge regarding electrical machines, DC generators & motors.	1, 2	2, 3
CO3	To understand principal operation of Single-Phase Transformers & their constructional details along with the study of electrical installations.	1, 2	2, 3
CO4	To gain knowledge on basics on power systems.	1, 2	2, 3
CO5	to gain knowledge on electronic systems such as junction diodes, transformers, amplifiers & filters etc.	1, 2	2, 3
CO6	To acquire knowledge on Amplifiers & Filters concepts in the field of various engineering Projects.	1, 2	2, 3

MODULE – I

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

MODULE – II

DC generators: Principle of operation, construction, EMF equation, types of DC generators. Losses and efficiency.

DC motors: Principle of operation, back EMF, torque equation, types of DC motors, Losses and efficiency

MODULE – III

Single Phase Transformers: Principle & constructional details and types, EMF equation, losses, efficiency, Applications.

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.

MODULE - IV
Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.
MODULE - V
Diode and applications: P-N Junction Diode - Diode equation, V-I characteristic, Temperature dependence, Zener Diode, Zener diode characteristics, Use of Zener diode as simple regulator **Transistor:** Bipolar Junction Transistor (BJT) - Construction, Principle of Operation, CB,CE and CC configurations
MODULE - VI
Amplifiers & Filters: Operational amplifier basics, op amp inverting and Non Inverting amplifier, Rectifiers and Filters - The P-N junction as a rectifier - A Half Wave Rectifier, Bridge Rectifier, Filters – Inductor Filters, Capacitor Filters

Text Books

1. D. P. Kothari and I. J.Nagrath, *Basic Electrical Engineering*, 3rd edition 2010, Tata McGraw Hill, 2010
2. William Hart Hayt, Jack Ellsworth Kemmerly, Steven M. Durbin (2007), Engineering Circuit Analysis, 7th edition, McGraw-Hill Higher Education, New Delhi, India.
3. B.L. Theraja, A.K. Theraja, A text book of Electrical Technology, (Vol 1 & 2), S. Chand Publishers, New Delhi.

Reference Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011
2. V.K. Mehta, Principles of Electrical and Electronics Engineering. S. Chand & Co 2010.
3. T. Thyagarajan, Fundamentals of Electrical and Electronics Engineering. SciTech publications, 2011, 5th Ed
4. D. C. Kulshreshta, "Basic Electrical Engineering", McGraw Hill, 2009.
5. P.S.Dhogal "Basic Electrical Engineering with Numerical Problems" McGraw Hill, 2006

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1G4	Introduction to Construction Management	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Understand various phases of a construction Project and gain insights into the Indian construction industry.	1, 11	1, 2
CO2	To know the types of business organisations and roles at various levels of organisational structure.	1, 11	1, 2
CO3	To understand the necessary skills of an ideal project manager and the critical success factors for the success of a project.	1, 11	1, 2
CO4	To gain insights on various types of project plans and basics of various planning techniques.	1, 11	1, 2
CO5	To know the basic concepts of resource levelling and its importance in construction project management.	1, 11	1, 2
CO6	To understand the concepts of organisational behaviour and basics of human resource management.	1, 11	1, 2

MODULE – I

Phases of a Construction project, Importance of construction and construction industry, Indian Construction Industry, Role of Project Management, Why Construction Project Management? participants/stakeholders of a construction project Architect, Client (Owner), Constructor, Engineer (Consultant), Subcontractor/Supplier/Vendor, Lawyer, Insurer, etc.

MODULE – II

Construction company, forms of business organization, Sole Proprietorship, Partnership, Corporation, Limited Liability Company (LLC), Private Limited Company, Public Limited Company, Government Enterprises, Joint Ventures, Structure of construction organization, Organizing for Project management - Director Level, President Level Construction Management Level, Project Management Level, Functional Management Level.

MODULE – III

Traits of a project manager, Strategies for Enhancing the Performance of a Project Manager, important traits of a project coordinator, Team Building Skill, Contract Implementation Skill, Project Organization Skill, ethical conduct for engineers, Factors behind the success of a Construction organization.

MODULE - IV
Introduction to construction planning - Types of Project Plans, Time Plan, Manpower Plan, Material Plan, Construction Equipment Plan, Finance Plan, work-breakdown structure, Methodology of WBS, Introduction to planning techniques—terminologies used, Advantages, disadvantages and application of various planning Techniques.
MODULE - V
Basics of Project Scheduling and Resource Levelling: Introduction, resource levelling, resource allocation, Importance of project scheduling, Bidding Procedure – Tasks involved in bidding Process, Basics of bidding models, Game Theory Models, Statistical Bidding Strategy Models, Cash Flow-Based Models.
MODULE – VI
Organizational Behaviour: Nature of organizational behaviour: Definition key elements, scope, model. Stages of evolution of OB. Foundations of Individual Behaviour: Personality, Perception, Learning Attitudes, Concepts of motivation. Foundations of Group Behaviour. **Introduction to Human Resource Management:** Introduction, Concept of Human Resource Management, Scope of Human Resource Management, History & Functions of Human Resource Management.

Text Books:

1. Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson,2012
2. Construction management Fundamentals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition
3. Project Management-Planning and Control---Rory Burkey 4th ed.—Wiley, India
4. Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication.

Reference Books:

1. Modern construction management--.Harris, Wiley India.
2. Project Management – K Nagrajan – New age International Ltd.
3. Work study – Currie.
4. Professional Construction Management Barrie-Paulson-McGraw Hill Institute Edition.
5. Project Management – Ahuja H.N. – John Wiely, New York.
6. Construction Project Management Planning, Scheduling and Controlling-Chitakara- Tata McGraw Hill, New Delhi
7. Construction Management – Roy, Pilcher .
8. Construction Management – O'Brien.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1A1	Innovation and Design Thinking	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain the knowledge on the inputs required for innovation and also gain familiarity on Entrepreneurship.	1	2
CO2	To get exposure on creative methods of ideation and the importance of protecting the ideas.	2	4
CO3	To gain knowledge on design thinking and types of thinking.	4,5,11	4
CO4	To gain familiarity on emerging technologies like Internet of things (IOT).	3,9	5
CO5	To understand the process of building the startup.	2	4
CO6	To gain knowledge on various startup funding and also to branding building for the startup.	2	4

MODULE – I

Introduction to Innovation: Meaning of Innovation, Difference between innovation and invention, Difference between Innovation and Creativity, Need to be Creative, Importance of Innovation, Innovation as a Competitive Advantage, Innovation Continuum, Innovation Cycle, Breakthrough innovations and its consequences on the society, Challenges in Innovation.

MODULE – II

Creative Thinking: Types of Creative Thinking, Creative Thinking Process, Components of Creativity, Characteristics of a Creative Mindset, New product ideas, Idea generation methods, Principles of Idea Generation, Killing the ideas through Stage Gate Models. Intellectual Property Rights, Importance of IPR, Role of WIPO, Case Studies on Patents and Infringement of Rights.

MODULE – III

Design Thinking & Liberal Art: Concept of Design Thinking, Stages of Design Thinking, Difference between Convergent Thinking and Divergent Thinking. Definition of Liberal Art and its Importance of Liberal Art, Role of Art and Culture to Innovate Business.

MODULE – IV

Emerging Technologies: Meaning of Internet of Things, Components of IoT, Benefits of IoT, examples of IoT enabled Innovations, Impact of IoT on Business, Future of IoT. Case Study on IoT. Innovation Leadership & Network: - Leadership, Skills and Characteristics of an Innovation Leadership, Meaning of Innovation Network, Significant of Innovation Network.

MODULE – V
Building Startup: Kelly Johnsons KISS Principle, Road map for building a start-up, crowd funding, advantages of crowd funding. Pricing strategies. Determining factors for Monetizing Innovation, Process of Monetization, reasons for failure of Monetization of Innovation, fixing the price of an Innovative Project. Detailed study on market potential.
MODULE – VI
Startup Funding & Branding: Sources of funding: Bootstrapping, Angel Investors, Venture capitalists, Schemes of Government through Startup India, role of Institutional support and Commercial Banks. Introduction to branding a startup and developing branding strategies.

Text Books:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems.
2. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4th edition, Elsevier, 2016.
3. David Ralzman, "History of Modern Design", 2nd edition, Laurence King Publishing Ltd., 2010
4. An AVA Book, "Design Thinking", AVA Publishing, 2010

Reference Books:

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3rd edition, Springer, 2007.
2. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1P1	Basic Computer Applications Laboratory	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know and use various hard ware and software components of computer.	5, 10	2, 3
CO2	To use various software applications like E-mail, sheets etc.	5, 10	2, 3
CO3	To use various Micro soft office packages like MS-word, PPT etc.	5, 10	2, 3

Part A

1. Introduction and history of computer, software & hardware concepts - bits, bytes - types of languages – Operating systems (windows, DOS, Linux).
2. Introduction to Word Processing Package (like MS office), toolbar, creating a new document, formatting text, inserting tables, pictures, page numbers and date/ time, spelling and grammar checking, taking printouts.

Part B

3. **Spread Sheets-** Introduction to spread sheets (like MS Excel), creating formulae, order of operations, borders and shading, inserting chart, taking print outs.
4. **Multi-media Presentations**- Introduction to multi-media presentation (like MS Power Point), creating a presentation, opening an existing presentation, creating a blank presentation, different Power Point views, slide manipulation, slide animation, slide transitions, view slide show, navigating while in slideshow, hyper linking to various other media/application outputs, scanning of different media in different formats, setting of options, resolution settings, management of file size, integrating partial scans of large documents, pack up a presentation for use on another computer, taking print outs.

Part C

5. Creating various E-mail (Outlook, Gmail, Yahoo, etc.) in various search engines (Google, Yahoo, Rediff, etc). Using E-mail (send, subject, Bcc, Cc, change in font, Font size, Attachments, Draft saving, customizing utilities). Using google applications- Drive, Google+, sheets, forms, docs, slides and other utilities

BCA Laboratory Experiments list:

1. Create a document of MS Word, writing a letter to Coordinator asking for one week leave by applying bold, paragraph alignment, Page borders etc.
2. Create a document of MS word, Write the information of the students which consist of Sl.no, Student name, Roll No., and Mobile No. in a tabular column by applying a watermark of our university logo.
3. Create a Document of MS Word, Insert a picture of your choice and describe it in 250 words.
4. Create a Sheet of MS Excel., Writing tables from 1 to 20 by applying formula.

5. Create a sheet of MS Excel., showing a line graph and bar graph which consist of % of sales of mobile phones of different companies as presented in below tabular column.

S.No	Year	Apple	MI	Samsung	Vivo
1	2017	35	30	32	35
2	2018	38	32	34	38
3	2019	39	36	36	39
4	2020	42	30	38	42
5	2021	45	20	40	44

6. Create a sheet of MS Excel., Showing a pie chart of % of sales of different companies

S.No	Description	%of sales
1	Company A	15
2	Company B	17
3	Company C	23
4	Company D	44
5	Company E	1

7. Create different slides in MS power point using design and animation (using clipart, different fonts).
8. Create a new E-mail ID in Gmail.com
9. Compose an email with 2 file attachments and send it to ysrafu.ctm@gmail.com cc to sudheer.reddy2305@gmail.com bcc to jagadishsai101@gmail.com
10. Compose and send a leave letter to higher authorities through e-mail with large size “Verdana” font. Use Bold, Italic, underlines and font colours wherever necessary.
11. Create a new folder in Google Drive share it to any G-mail ID with editing privileges
12. Create a google form to collect basic data like Name, Age, Gender, Nationality etc.,
13. Create a google sheet to collect table of data of basic student details of a college.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1P2	Communication Skills Laboratory	0	0	3	3	50	50	100

Cos	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To listen, read & speak effectively using vocabulary.	10	1,2
CO2	To write effectively, when necessary, at the workplace for effective communication.	10	1,2
CO3	To improve employability skills by writing effective resume and can face the interview with confidence.	10	1,2
CO4	To give effective presentations in various seminars/ workshops/ conferences & can carry out day to day communication at work place by using technology to facilitate efficient interpersonal communication.	10	1,2

Activity List

1. Phonetics
2. Identifying context/ sentences
3. Reading comprehension
4. Describing places/ persons/ picture
5. Introducing/ Ice breaking activity
6. Role play or conversational practice
7. Etiquettes of Telephonic conversation
8. JAM
9. Oral Presentations
10. Group Discussions
11. Letter writing
12. Debates
13. Interview skills- Basic HR questions

Software: Orel, Walden Infotech, Young India Films

Text Books:

1. Muralikrishna C., Sunita Mishra "Communication Skills for Engineers" 2nd edition, Pearson, New Delhi 2010.
2. Krishna Mohan &Meera Banerji: Developing Communication Skills Macmillan India.
3. Raman, M & Sharma, S., Technical Communication: Principles and Practice. Oxford University Press, New Delhi 2014.

Reference Books:

1. Swan, Michael, Practical English Usage, (4e) Oxford University Press, London 2017.
2. Vyas Manish A., Yogesh L. Patel, "Tasks for the English Classroom", MacMillan, New Delhi, 2012.
3. Communication Skills, by Sen, Leena: Prentice Hall of India, New Delhi
4. Communication Skills, by Prasad, P: S.K. Kataria& Sons
5. Course in Listening and Speaking Skills Part I by GeethaRajivan, Kiranmai: Foundation Books Pvt Ltd.
6. Enrich your Communication in English by Sujatha Mukiri: Lorven Publication Hyd

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
I	CT21B1P3	Engineering Graphics	1	0	3	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the principles of Engineering Drawing.	5, 10	2, 6
CO2	To construct various types of curves commonly used in engineering practice and be aware of basic principles of projections of points.	5, 10	2, 6
CO3	To learn basic principles of projections of lines and planes.	5, 10	2, 6
CO4	To understand and draw the projections of solids.	5, 10	2, 6
CO5	To understand Principles and views of Isometric and orthographic projections.	5, 10	2, 6
CO6	To draw detailed drawings of doors, windows, ventilators, roofs and to learn basics tools of AUTOCAD.	5, 10	2, 6

MODULE - I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Instruments and their uses, lettering and dimensioning, BIS conventions.

Scales: Reduced and Enlarged scales, Representative fraction, plain & diagonal.

MODULE - II

Curves used in Engineering Practice:

Conic Sections (Ellipse, Parabola and Hyperbola -General method only) including the Rectangular Hyperbola.

Projection of points: Introduction, Two View Projections of Points, Three View Projections of Points - Projections of a point situated in first quadrant only.

MODULE - III

Projection of lines: Lines inclined to one or both planes, Problems on projections, Finding True lengths & traces only.

Projection of planes: Introduction, Two View Projections - Plane parallel to one of the principal planes and perpendicular to the other, Plane inclined to one of the principal planes and perpendicular to the other, Plane perpendicular to both H.P and V.P, Oblique plane (plane inclined to both H.P and V.P).

MODULE - IV

Projections of solids: Introduction, Types of Solids, Two-View Drawings - Axis perpendicular to one of the principal planes - Axis inclined to one of the principal planes and parallel to the other - Axis inclined to both the principal planes.

MODULE - V
Isometric & Orthographic Projections: Principles of Orthographic Projection, First and Third Angle Projections, methods and presentation of orthographic views, Principles of isometric projections – Isometric scale, Isometric axes, Isometric planes, Isometric view. Isometric views of lines, planes, regular solids, and combination of two solids. Conversions of Orthographic views into Isometric views and Conversion of Isometric views to Orthographic views.
MODULE - VI
Basics of Auto CAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

Exercises:

1. Practice exercise using basic drawing commands
2. Practice exercise using editing commands

Text books:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers, Edition2016.
2. Engineering Drawing, K.L. Narayana, P. Kanniah, Scitech Pub, Edition 2016
3. K.Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
4. Building Planning & Drawing by Dr N. Kumarswamy & A. Kameswar Rao, Charkator publications

Reference Books:

1. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad,
2. PHI Learning, Eastern Economy editions.
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
4. K.C.John, Engineering Graphics, 2/e, PHI,2013
5. Basant Agrawal B. & Agrawal C. M., Engineering Graphics, TMH Publication, 2016.
6. K. Balaveera Reddy et al, Computer Aided Engineering Drawing, CBS Publications, 2017

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
I	**MC21B101**	**UHV-1 Student Induction Program (mandatory AICTE)**	**2**	**0**	**0**	**0**	**-**	**-**	**-**

COs	Course Outcomes	POs	BTLs
	The Student Induction Program (SIP) The 3-week Student Induction Program (SIP) is to prepare newly admitted undergraduate students for the new stage in their life by facilitating a smooth transition from their home and school environment into the college and university environment through various discussions and activities. The SIP has been formulated with specific goals to help students to:		
CO1	Become familiar with the ethos and culture of the institution (based on institutional culture and practices)	**NA**	**NA**
CO2	Set a healthy daily routine, create bonding in batch as well as between faculty members and students	**NA**	**NA**
CO3	Get an exposure to a holistic vision of life, develop awareness, sensitivity and understanding of the Self---family---Society---Nation---International---Entire Nature	**NA**	**NA**
CO4	Facilitate them in creating new bonds with peers and seniors who accompany them through their college life and beyond	**NA**	**NA**
CO5	Overcome weaknesses in some essential professional skills – only for those who need it (e.g. Mathematics, Language proficiency modules)	**NA**	**NA**

The various modules or core areas recommended for the 3-week SIP are:

SIP Module 1: Universal Human Values I (UHV I) 22 hours

The purpose is to help develop a holistic perspective about life. A self-reflective methodology of teaching is adopted. It opens the space for the student to explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society and as an unit in nature. Through this process of self-exploration, students are able to discover the values intrinsic in them. The session wise topics are given below:

Session No	Topic Title	Aspirations and Issues	Basic Realities (underlying harmony)
1	Welcome and Introductions	Getting to know each other	Self-exploration
2 and 3	Aspirations and Concerns	Individual academic, career… Expectations of family, peers, society, nation… Fixing one's goals	Basic human aspirations Need for a holistic perspective Role of UHV
4 and 5	Self-Management	Self-confidence, peer pressure, time management, anger, stress… Personality development, self-simprovement…	Harmony in the human being
6 and 7	Health	Health issues, healthy diet, healthy lifestyle Hostel life	Harmony of the Self and Body Mental and physical health
8, 9, 10 and 11	Relationships	Home sickness, gratitude towards parents, teachers and others Ragging and interaction Competition and cooperation Peer pressure	Harmony in relationship Feelings of trust, respect… gratitude, glory, love
12	Society	Participation in society	Harmony in the society
13	Natural Environment	Participation in nature	Harmony in nature/existence
14	Sum Up	Review role of education Need for a holistic perspective	Information about UHVII course, mentor and buddy
15	Self-evaluation and Closure	Sharing and feedback	

SIP Module 2: Physical Health and Related Activities 51 hours

This module is intended to help understand the basic principles to remain healthy and fit and practice them through a healthy routine which includes exercise, games etc.

SIP Module 3: Familiarization of Department/ Branch and Innovation 06 hours

This module is for introducing and relating the student to the institution/department/branch; how it plays a role in the development of the society, the state, region, nation and the world at large and how students can participate in it.

SIP Module 4: Visit to a Local Area 10 hours

To relate to the social environment of the educational institution as well as the area in which it is situated through interaction with the people, place, history, politics…

SIP Module 5: Lectures by Eminent People 06 hours

Listening to the life and times of eminent people from various fields like academics, industry etc. about careers, art, self-management and so on enriches the student's perspective and provides a holistic learning experience.

SIP Module 6: Proficiency Modules 06 hours

This module is to help fill the gaps in basic competency required for further inputs to be absorbed. It includes effort to make student proficient in interpersonal communication and expression as well as awareness about linguistic and thereafter NLP.

SIP Module 7: Literature / Literary Activities 30 hours

Through the exposure of local, national and international literature, this module is aimed at helping the student learn about traditional as well as contemporary values and thought.

SIP Module 8: Creative Practices 49 hours

This module is to help develop the clarity of humanistic culture and its creative, joyful expression through practice of art forms like dance, drama, music, painting, pottery, sculpture etc.

SIP Module 9: Extra Curricular Activities 06 hours

This is a category under which things that are not placed in any of the above may be placed. Some clubs and hobby group may be made for each of the above categories, so that students may pursue them even after SIP.

The recommended hours to be allocated are given above. Depending on the available faculty, staff, infrastructure, playgrounds, class timings, hostellers and day scholars etc., the timetable for these activities may be drawn up. Of course, colleges may conduct an inaugural function at the beginning of the SIP; and they may also conduct a celebratory closing ceremony at the end of the SIP. In particular during the lockdown phase, appropriate care may be taken and some or all activities may be planned in distance-learning or on-line mode.

Implementation:

The institution is expected to conduct the 3-week SIP under the guidance of the Director/Principal or Dean Students or a senior faculty member. For this, the institution is expected to make an SIP Cell. The SIP Cell will be responsible for planning, and then implementation of the SIP.

Follow up:

The SIP is only the beginning of the interaction with newly joined students.

An important part of the SIP is to associate one faculty mentor to every small group of about 20 students; and also associate one senior student buddy to an even smaller groups of about 5 students for the guidance required for holistic development of the newly joined student throughout his/her time in the institution/college.

These activities are to be continued in the ongoing academic program along with other cultural activities through the Student Activity Cell (SAC).

SEMESTER II

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
II	CC21B2G1	Environmental Chemistry	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To explain the principles of reverse osmosis, electrodialysis and can differentiate between temporary and permanent hardness of water.	2, 4	1, 2
CO2	To Compare various applications of batteries and can apply Nernst equation for calculating electrode and cell potentials	2, 4	1, 2
CO3	To understand mechanism of corrosion and its preventive measures.	6,7	1, 2
CO4	To understand different types & applications of polymers and fuels.	6,7	1, 2
CO5	To understand and analyse various engineering materials and their applications.	6,7	1, 2
CO6	To understand various concepts of colloids, micelle and nanomaterials.	6,7	1, 2

MODULE - I

Water Technology: Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

MODULE - II

Electrochemistry and Applications: Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells –working of the cells.

MODULE - III

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

MODULE - IV

Polymers and Fuel Chemistry: Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization. Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC and Bakelite Elastomers Fuels – Types of fuels, calorific value, Analysis of coal, Liquid Fuels refining of petroleum. Alternative fuels- propane, methanol and ethanol, bio-fuels.

MODULE - V
Advanced Engineering Materials: Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications Refractories- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.
MODULE - VI
Surface Chemistry and Applications: Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solidgas interface, solid-liquid interface, adsorption isotherm.

Text Books:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15th edition, Dhanpat Rai & Sons, Delhi, 2014.
2. B.S Murthy and P. Shankar, a Text Book of Nanoscience and Nanotechnology, University Press, 2013.
3. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.

Reference Books:

1. Jaya Shree Anireddy, Textbook of Engineering Chemistry: Wiley Precise Textbook Series, 2019.
2. O.G.Palanna, Engineering Chemistry, Tata McGraw Hill Education Pvt Ltd, 2009.
3. Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, 2003
4. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
5. V. Subba Reddy, K.N. Jayaveera and C. Rama chandraiah, Engineering Chemistry, Mc Graw Hill, 2020
6. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
II	CT21B2C1	Engineering Mechanics	3	1	0	4	50	50	100

COs	Course Outcomes	POs	BTL
	The student will be able		
CO1	To understand force systems and can draw free body diagrams and also can determine the resultant of forces.	1, 2, 3	3, 4
CO2	To determine the moments and support reactions.	1, 2, 3	3, 4
CO3	To learn the concept of friction and its applications	1, 2, 3	3, 4
CO4	To Determine the Centroids of Composite sections and Centre of Gravity of bodies.	1, 2, 3	3, 4
CO5	To Determine the moment of inertia of areas.	1, 2, 3	3, 4
CO6	To learn the concept of kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.	1, 2, 3	3, 4

MODULE – I

Equilibrium of Force System: Classification of force systems, composition and resolution of forces, Resultant of a force system, Simplest Resultant of Two dimensional concurrent and Non-concurrent Force systems Parallelogram law, Equilibrium of force systems, Moment of a force and couple, Lami's theorem, Free body diagrams.

MODULE – II

Support Reactions: Types of Supports and loads – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

Analysis of Plane Trusses: Analysis of plane truss by method of joints and method of section.

MODULE – III

Friction: Types of friction, Laws of friction, Co-efficient of friction, Angle of friction, Angle of repose, Cone of friction, concept of static and dynamic friction.

Applications: Body on horizontal/ inclined plane, two bodies in contact, Ladder friction, Wedge, Screw jack and differential Screw jack.

MODULE – IV

Centroid And Center of Gravity: Centroids of simple figures, Centroids of Composite sections, pappus theorem. (Basic Numerical problems only).

Centre of Gravity of bodies and its implications, Centre of Gravity of Composite figures. (Basic Numerical problems only).

MODULE – V

Area Moment of Inertia: Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures, radius of gyration (Basic Numerical problems only).

Mass Moment of Inertia: Moment of Inertia of Simple solids, Moment of Inertia of composite masses (Basic Numerical problems only).
MODULE – VI
Kinematics: Definitions -Displacement, acceleration, Average acceleration, variable acceleration, acceleration due to gravity, velocity, average velocity, instantaneous velocity, speed. Rectilinear and Curve linear motion, Velocity and Acceleration, Motion of a Rigid Body – Types and their Analysis in Planar Motion. **Mechanical Vibrations:** Definitions, Concepts, Simple Harmonic motion - Free vibrations - Simple Compound and Torsional pendulum- Numerical problems.

Text Books:

1. R.K. Bansal, a Text Book of Engineering Mechanics, Laxmi Publications.
2. Hibbeler RC, Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, 2016.
3. Punmia, B. C., Ashok Kumar Jain and Arun Kumar Jain, Mechanics of Materials, Laxmi Publications Pvt. Ltd.

Reference Books:

1. Timoshenko & Young, Engineering Mechanics, Tata McGraw–Hill Publications
2. Bhavikatti and Rajasekharappa, Engineering Mechanics, New Age Intl. Publications.
3. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press.
4. Engineering Mechanics, Shames & Rao – Pearson Education.
5. Engineering Mechanics, Fedrinand L.Singer – B.S. Publishers.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
II	CT21B2C2	Building Materials	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Develop knowledge of materials like stone, bricks, clay & cement etc.	7, 12	1, 2
CO2	To gain the knowledge on the materials like lime, wood and Properties and Applications of various metals.	7, 12	1, 2
CO3	To learn the Engineering properties of materials like Glass, paints etc.	7, 12	1, 2
CO4	To understand the concepts and essential requirements of flooring and roof coverings.	7, 12	1, 2
CO5	To gain the knowledge on various properties of Damp proofing and water proofing.	7, 12	1, 2
CO6	To learn in detail about various properties of insulation and its application.	7, 12	1, 2

MODULE – I

Stone: Geological Classification of rocks – test for stones, uses of stones, deterioration of stone, preservation of stones, stones available for construction in India their properties and uses. Stones for finishes – cutting & polishing –granite and marble. Artificial stone and their uses.

Bricks and Clay Products: Composition of good brick, properties and uses of bricks, classification of bricks, shape of bricks, fire bricks, Tiles, terra cotta, stoneware, earthenware, porcelain, their properties and uses.

Cement: Manufacture of Cement, Composition of Cement and various types of cements.

MODULE – II

Lime: Basic definitions types of binding sources of lime classification of lime properties and uses of various types of limes.

Wood: Softwood and Hardwood– physical properties and uses – Defects – Conversion – seasoning – Decay and preservation of timber – Fire retardant treatment – Anti termite treatment. Industrial timber – ply wood, hard board, jolly board, Block board, particle board. Fiber board – properties and uses.

Metal: Properties and Applications of Cast Iron, Stainless Steel, Aluminium in building construction – Doors, windows, frames.

MODULE – III

Glass: Classification of glass, types of glass, physical properties and uses of glass, special varieties of glass and Architectural glass.

Paints: Constituents and characteristic of an ideal paint, types of paints, defects in painting, painting on different surfaces.

Varnishing: characteristics of an ideal varnish, types of varnishes, process of varnishing.

Distemper: properties of distempers, process of distempers.

Wall finishes: wall paper, whitewashing and color washing for walls

MODULE – IV
Floorings: Introduction, essential requirements of a floor, factors affecting selection of flooring material, Various natural as well as artificial flooring materials like brick, flag stone, tiled, cement concrete, granolithic, terrazzo, marble, shahbad stones timber flooring, vitrified tiles, ceramic tiles, Mosaic, rubber, Linoleum, and PVC and PVA flooring **Roof Coverings:** Introduction, requirements of good roof, technical terms, classification, types of roof coverings for pitched roof, Roofing tiles and roofing with cement products like A.C. sheet roofs, G.I. Sheets roofs, slates.
MODULE – V
Damp proofing: Hot applied and cold applied – Emulsified asphalt, Bentonite clay. Butyl rubber, silicones, Vinyl's, Epoxy resins and metallic water proofing materials, their properties and uses. **Water proofing:** water proofing membranes such as rag, asbestos, glass felt, plastic and synthetic rubber-vinyl, butyl rubber, neoprene, polyvinyl chloride – prefabricated membranes sheet lead, asphalt their properties and uses.
MODULE-VI
Thermal insulation: Heat transfer heat gain/ loss by materials - vapour barriers and rigid insulations, blanket, poured and reflective insulation – Insulation properties and uses of spun glass foamed glass, cork, vegetable fibers, Gypsum, plaster of Paris, hydride gypsum properties and uses **Acoustics insulation:** porous, baffle and perforated materials such as Acoustic plastic, Acoustic tiles, wood, partition board, fiber board, cook, quilts and mats – their properties and uses – current developments.

Text Books:

1. W.B. Mickay – Building construction Vol 1, 2 and 3 – Longmans, UK 1981.
2. R.Chudley – Building Construction Handbook – BLPD, London 1990.
3. S.C.Rangwala – Engineering materials – Charotar Publishing, Anand.

Reference Books:

1. Dr.B.C.Punmia – Building construction
2. R.Chudley, construction Technology.
3. Francies D.K.Ching – Building Construction illustrated. VNR, 1975

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
II	CT21B2C3	Building Planning and Drawing	2	2	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the planning of various types of buildings and their properties.	3, 11	1, 2
CO2	To familiarize with various building byelaws and regulations.	3, 11	1, 2
CO3	To acquire knowledge on various standards required for Residential and public buildings.	3, 11	1, 2
CO4	To know about various aspects and parameters for Safety and Comfort of buildings.	3, 11	1, 2
CO5	To gain knowledge on various components of building, sign Conventions & Bonds.	3, 11	6
CO6	To develop the proficiency in drawing plans, sections and elevations of different types of buildings.	3, 11	6

PART- A

MODULE – I

Planning Of Buildings: Types of buildings, types of residential buildings, site selection for residential building, orientation of buildings; aspect; prospect; privacy; furniture requirement; grouping; circulation; sanitation; lighting; ventilation; cleanliness; flexibility; elegancy; Economy; practical considerations.

MODULE – II

Building Byelaws And Regulations: Introduction- Terminology ;Objectives of building byelaws; Minimum plot sizes; Open space requirements ;Plinth area, floor area, carpet area; Floor area ratio (FAR), Floor space Index (FSI) ;areas for different units; Principles underlying building byelaws ; built up area limitations – Height of Buildings ,Wall thickness, lighting and ventilation requirement, safety from fire, drainage and sanitation; applicability of the bye-laws.

MODULE – III

Planning Of Residential Buildings: Minimum standards for various parts of buildings – requirements of different rooms and their grouping – characteristics of various types of residential buildings

Planning Of Public Building: Planning of Educational institutions, Hospitals, Office buildings, Banks, Industrial buildings, Hotels and Motels, Hostels, Bus Station.

MODULE – IV

Buildings Safety And Comfort: aspects of safety-structural, health, fire and constructional safety. Components of building automation system - HVAC, electrical lighting, Security, fire-fighting, communication etc. design for thermal comfort, ventilation comfort, air conditioning comfort, lighting comfort, noise and acoustic comfort.

PART – B
MODULE – V
Sign Conventions And Bonds: Brick, Stone, Plaster, Sand filling, Concrete, Glass, Steel, Cast iron, Copper alloys, Aluminum alloys etc., Lead, Zinc, tin, and white lead etc., Earth, Rock, Timber and Marble. English bond & Flemish bond; odd & even courses for one, one and half, two and two and half brick walls in thickness at the junction of a corner, Garden wall bonding: honey comb, raked and herring bone bond **Basic building components:** Cross section of a small building to understand foundation, plinth beam flooring, sill, lintel, roof beam and slabs parapet & weathering course, • **Foundation:** types of foundations, Random rubble, SR & Ashlar • **Walls:** Details of walls section across the opening (door & window) • **Doors:** Panelled Door – paneled and glazed door. • **Windows:** glazed windows – paneled windows; casement window (without mullion), bay window, & French window. • **Ventilator:** Swing ventilator – Fixed ventilator, louvered & top hung ventilator • **Roofs and Trusses:** Couple roof – Collar roof; Kind Post truss – Queen post truss. • **Arches:** arches in brick and stone (flat, segmental, semi-circular and pointed)
MODULE – VI
Given line diagram with specification to draw plan, section and elevation of: 1. Residential Building 2. Hospital 3. Schools 4. Post office 5. Corporate Office Building6. Hotels 6. Bank buildings 7. Bus stations 8. Industrial buildings

EXTERNAL EXAMINATION PATTERN:

The end External examination paper should consist of Part- A and Part-B.

Part- A consists of five questions of theory from first four units (i.e., Module - I to Module – IV). Student should answer three out of five questions. Each question carries 10 marks. Total marks for Part-A is 30 marks.

Part- B consists of three questions from next two units (i.e., Module V & Module VI) with either or choice from drawing portion. Student should answer two out of three questions. Each question carries 10 marks. Total marks for Part-B is 20 marks.

Text Books:

1. Planning and Designing and Scheduling – Gurucharan singh and Jagadish singh- Standard publishers.
2. Building planning and design – N. Kumara swamy and A. Kameswara rao. Charitor publications.

Reference Books:

1. Building by laws by state and Central Governments and Municipal corporations. National Building Code
2. 2. Building drawing with an integrated approach to building environment-M.G.Saha, G.M.Kale, S.Y.patki-Tata Mc Graw Hill.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
II	CC21B2C4	Operational Research Methods	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the concepts related to Probability and its application in engineering.	2, 4	2, 3
CO2	To learn and apply the hypothesis and significance testing of data in various Engineering applications.	2, 4	2, 3
CO3	To understand various linear programming methods and their formulations.	1, 2	1, 3
CO4	To understand different Characteristics & applications of Dynamic Programming and Decision making strategies.	1, 2	1, 3
CO5	To understand various qualitative and quantitative methods of forecasting.	1, 2	1, 3
CO6	To understand various game theory simulation strategies in construction.	1, 2	1, 3

MODULE - I

Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Bayes' Theorem.Random variables – Discrete and continuous Distributions, Binomial, poisson's distributions and Normal distribution – Related properties.

MODULE - II

Test of Hypothesis: Means – Hypothesis concerning one and two means– Type I and Type II errors. One-tail, two-tail tests.

Tests of significance: Student's t-test, F-test, Ψ^2 test. Estimation of proportions.

MODULE - III

Linear Programming: Formulation Of LP Problems, Graphical Method, Simplex Method, Transhipment And Assignment Problems: Transportation Problem: Basic Feasible Solutions Using N-W Corner Rule, Least Cost Method, Vogel's Approximation Method. Optimality test Solutions Using Modified Distribution (MODI) Method.

MODULE - IV

Dynamic Programming: Introduction, Decision Tree and Bellman's Principle of Optimality, Characteristics of D.P.P, Dynamic Programming Algorithm, Applications of Dynamic Programming.

Decision Theory: Introduction, Basic Terminologies in Decision Theory, Steps in the Decision-making Process, Decision-Making Environment - Decision-making Under Conditions of Certainty, Decision-making Under Uncertainty and Decision-making Under Conditions of Risk, Decision Under Uncertainty - Maximin Criterion, Maximax Gain Criterion or Minimin Loss Criterion, Laplace Criterion, Savage Minimax Regret Criterion, Decision Tree Analysis.

MODULE - V
Forecasting: Quantitative Methods-Time Series (Average Method, Moving Average Method, Exponential Smoothing, Mean Square Error), Regression Analysis. Qualitative Methods.
MODULE - VI
Games Theory Simulations Applied To Construction: Introduction, Definition, Pay-off, Types of Games, The Maximin-Minimax Principle, Saddle Points, Games without Saddle points (Mixed Strategies), 2x2 Games without Saddle Point, Graphical Method for 2 x n or m x 2 Games, Dominance Property.

Text Books:

1. Probability & Statistics, T.K.V. Iyengar, B. Krishan Gandhi and Others, S. Chand & Company.
2. Probability & Statistics, Ravindranath, B.S.R. Murthy, I.K.International Pvt. Ltd.
3. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
4. S. Kalavathy, Operations Research, Vikas publishing house.
5. Anand Sharma, Operations Research, Himalaya publishing house.

Reference Books:

1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
2. Probability & Statistics, Amold O. Allen, Academic Press.
3. Operations Research: An Introduction, Taha, H.A., Prentice Hall INDIA, New Delhi,2010.
4. Quantitative Methods In Construction Management, James, A., Adrain, American Elsevier Publishing Co., Inc., 1973.
5. Quantitative Techniques In Management , Vohra, N.D. Tata Mcgraw Hill Co., Ltd, New Delhi, 1990.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
II	CT21B2A1	Basics of Entrepreneurship	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To acquire basic knowledge on Skills of Entrepreneurship.	5, 7, 11	1, 2
CO2	To understand and Analyse the requirements of a typical problem.	5, 7, 11	1, 2
CO3	To understand various business Models and their validity.	5, 7, 11	1, 2
CO4	To acquire knowledge on the basic cost structure, Revenue Streams and the pricing strategies.	5, 7, 11	1, 2
CO5	To acquire knowledge about the project management and its techniques.	5, 7, 11	1, 2
CO6	To get exposure on marketing strategies and business regulations for the Start up.	5, 7, 11	1, 2

MODULE - I

Introduction to Entrepreneurship & Self Discovery: - Define Entrepreneurship, Entrepreneurship as a Career option, Find your Flow, Stock of Your Means, Characteristics, Qualities and Skills of Entrepreneurship, Effectuation, Principles of Effectuation, Life as an Entrepreneur, Stories of Successful Entrepreneurs.

MODULE - II

Opportunity & Customer Analysis: - Identify your Entrepreneurial Style, Methods of finding and understanding Customer Problems, Run Problem Interview, Process of Design Thinking, Identify Potential Problems worth Solving, Customer Segmentation, Niche Marketing and Targeting, Craft your Values Proportions, Customer-driven Innovation.

MODULE - III

Business Model & Validation: - Introduction to Business Models, Lean approach to Business Model Canvas, Blue and Red Ocean Strategies, the Problem-Solution Fit, Build your Solution Demo, Solution Interview Method, Identify Minimum Viable Product (MVP), Product-Market fit test.

MODULE – IV

Economics & Financial Analysis: - Revenue Analysis, Identify different Revenue Streams and Costs Analysis – Startup Cost, Fixed Cost and Variable Cost, Break Even Analysis, Profit Analysis, Introduction to Pricing, different Pricing Strategies, Sources of Finance, Bootstrapping and Initial Financing, Practice pitching to Investors and Corporate.

MODULE - V

Team Building & Project Management: - Leadership Styles, Shared Leadership Model, Team Building in Venture, Roles and Responsibilities of team in venture, Explore collaboration tools and techniques, Brainstorming, Introduction to Project Management, Project Life Cycle, Create a Project Plan.

MODULE - VI
Marketing & Business Regulations: - Positioning, Positioning Strategies, Negotiation Skills, Branding, Branding Strategies, Selecting and Measuring Channels , Customer Acquisition, Selling Process, Selling Skills, Sales Plans. Business regulations – List of Required Registrations, Compliance Check List, Business Structures and Legal Entities.

Text Books:

1. Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, Sixth Edition, New Delhi, 2006.
2. Thomas W. Zimmerer, Norman M. Scarborough, Essentials of Entrepreneurship And Small Business Management, Fourth Edition, Pearson, New Delhi, 2006
3. Alfred E. Osborne, Entrepreneur's Toolkit, Harvard Business Essentials, HBS Press, USA, 2005.

Reference Books:

1. Madhurima Lall, Shikha Sahai, Entrepreneurship, Excel Books, First Edition, New Delhi, 2006.
2. S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2007.
3. H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.
4. S.R. Bhowmik, M. Bhowmik, Entrepreneurship-A tool for Economic Growth And A key to Business Success, New Age International Publishers, First Edition, (formerly Wiley Eastern Limited), New Delhi, 2007.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
II	CT21B2P1	Programming for problem solving	1	0	3	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To formulate simple algorithms for arithmetic and logical problems and to translate algorithms to programs (in C Language).	3,4	1, 2
CO2	To Solving programming using various control statements and Use functions to solve the given problem.	3,4	1, 2,3
CO3	To implement different Operations using arrays understanding the Pointer	3,4	1, 2,3,4
CO4	To understand structures, unions, and File Handling.	3,4	1, 23,4
CO5	To understand the Pre-processors and command line arguments.	3,4	2,3,4,5
CO6	To implement searching, and sorting Techniques.	3,4	2.3.4.5

PART- A (THEORY)

MODULE – I

Introduction and first Program: Why Programming, Types of Programming, Introduction to C, Understanding First C Program, Executing using IDE.

Variables and Data Types: Identifiers, Keywords, Data Types, Variables, Constants.

Console IO Operations: printf() function, scanf() function, Un formatted Functions.

Operators and Expressions: Expressions, Types of Operators, Type Casting.

MODULE – II

Control Flow Statements: Decision Making in C, If Statement, Switch Statement, Unconditional Branching, Loop Statements.

Working with Functions: Introduction to Functions, categories of Functions, Parameter Passing Techniques, Scope and Life time of Variables in function, Storage Classes of Variables, Recursive Functions.

MODULE – III

Working with Arrays: Basics, Arrays Declaration and Initialization, Sample Programs, Multidimensional Arrays, Arrays and Functions.

String Handling: Introduction, Standard string library functions, Array of pointers to string.

Pointers: Understanding Pointers, Types of Pointers, Dynamic allocation of memory, Difference between malloc() and calloc().

MODULE – IV

Structures and union: overview of Structures, Array of Structures, Nested Structures, type def keyword,

Passing Structures to Functions, Structure and Pointers, Unions.

File Handling: Overview of Files, Opening and Closing of Files, Writing and Reading in Text Format, Writing and Reading in Binary Format.

MODULE – V

Pre-Processor Directives: Pre-Processor Directives, #define Macro, Conditional Compilation, Pre-defined Macros, #include and Header Files.

Command Line Arguments and Variable Number of Arguments: Command Line Arguments, Variable Arguments.

MODULE – VI

Searching Techniques – Sequential Search and Binary Search

Sorting Techniques– Bubble Sort, selection sort, insertion sort, quick sort.

PART- B (PRACTICAL)

Operators and Evaluation of Expressions

1. Write a C Program to check whether a number is even or odd using ternary operator
2. Write a C Program to perform the addition

CONTROL STRUCTURES

1. Write a C program to find the sum of individual digits of a positive integer.
2. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to print the numbers in triangular form

   1

   1 2

   1 2 3

   1 2 3 4

ARRAYS

1. Write a C program to find the second largest integer in a list of integers.
2. Write a C program to perform the following:
   i. Addition of two matrices
   ii. Multiplication of two matrices
3. Write a C program to merge two sorted arrays into another array in a sorted order.

STRINGS
1. Write a C program to find a string within a sentence and replace it with another string.
2. Write a C program to determine if the given string is a palindrome or not.
FUNCTIONS
1. Write C programs that use both recursive and non-recursive functions i. To find the factorial of a given integer. ii. To find the greatest common divisor of two given integers.
2. Write a C program that uses a function to reverse a given string.
POINTERS
1. Write a C program to find the length of string using pointers.
2. Write a C program to compare two strings using pointers.
3. Write a C program to copy a string from source to destination using pointers.
FILES
1. Write a C program to display the contents of a file
2. Write a C program to copy the contents of one file to another.
COMMAND LINE ARGUMENTS
1. Write a C program to read arguments at the command line and display it.
2. Write a C program to read two numbers at the command line and perform arithmetic operations on it.

Text Books:

1. E. Balagurusamy, C Programming and Data structures, Fourth Edition, McGraw-Hill.
2. Remo Theraja, Programming in C, second edition, Oxford.
3. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan AndersonFreed, Computer Science Press.
4. Programming in C and Data Structures, J.R. anly, Ashok N.K amthane and A.Ananda Rao, Pearson Education.

Reference Books:

1. Computer science, a structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. Data Structures Using C – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. C& Data structures – P. Padmanabham, B.S. Publications.
4. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
5. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
6. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
7. YashavantKanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition,2012.
8. Oualline Steve, "Practical C Programming", O'Reilly Media, 3rd Edition,1997.
9. King K N, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition,2015.
10. Kochan Stephen G, "Programming in C – A Complete Introduction to the C Programming Language",Sam's Publishers, 3rd Edition,2004.
11. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India,1st Edition,1994.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
II	CT21B2S1	Construction Material and Practices Studio	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know various materials such as bricks, cement, aggregates etc., used in construction.	9, 10	3, 6
CO2	To understand various components such as Flooring, Doors, Windows, Ceiling & Walls etc., of the building.	9, 10	3, 6
CO3	To gain knowledge on various Electrical and Plumbing services in construction of a building.	9, 10	3, 6
CO4	To gain knowledge on various procedures of building construction.	9, 10	3, 6

Research through field visit & Report on:-

PART-A: Materials

1. Bricks- Types of bricks, Sizes of bricks, Market prizes, Applications
2. Cement- Types of cements, Packing weights, Companies providing different types of cement, Prizes, Applications
3. Paints- Types of paints, Mixing materials in paints, Companies providing different types of paints, Prices, Different colours available in paints, Applications
4. Coarse Aggregates (CA) - Sizes of CA, CA extraction, By-product from crushing plants, Applications of CA & By-product.
5. Fine Aggregates (FA) - Minerals in FA, Conditions of FA suitable for construction, Applications of various sizes of FA.
6. Steel- Sizes of steel, Companies, Prices, Density, Applications

PART-B: Elements

1. Flooring: Types of materials used for flooring, Sizes of materials available, Companies, Prices
2. Doors: Types of materials used for doors, Sizes, Decorative materials, Companies, Prices
3. Windows: Types of materials used for windows, Sizes, Decorative materials, Companies, Prices
4. Ceiling & Walls: Types of decorative materials used, Companies, Prices

PART-C: Building Services

1. Electrical: Different electrical elements (wires, colours of wires & uses, switches, types of switches, modals, electrical elements) used, Companies, Prices

2. Plumbing: Different materials used (sanitary materials, pipes, sizes of pipes), Companies, Prices
Part -D: Field visit report on Step by Step procedure in Construction of
1. Building
2. Roads (Flexible and Rigid Pavements)
3. Dams

Note: The students must prepare a detailed report on Market survey/Field visit as prescribed by the laboratory coordinator. The internal and external assessment will be based on the report submissions.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
II	MC21B201	Environmental Studies	2	0	0	0	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the importance of environment and natural resources	6, 7	1, 2
CO2	To acquire the knowledge on various principles of eco- systems and their functions.	6, 7	1, 2
CO3	To gain the knowledge on various principles, threats and conservation of bio diversity.	6, 7	1, 2
CO4	To understand the importance of national and international concern for protection of environment from various pollutants.	6, 7	1, 2
CO5	To understand various social Issues related to Environment.	6, 7	1, 2
CO6	To understand the impact of human population on the environment.	6, 7	1, 2

MODULE - I

Environmental studies–Introduction: - Definition, scope and importance, Measuring and defining environmental development indicators.

Environmental and Natural Resources: Renewable and non-renewable resources - Natural resources and associated problems - Forest resources - Use and over - exploitation, deforestation, case studies - Timber extraction, dams- benefits and problems

MODULE - II

Basic Principles of Ecosystems Functioning: Concept of an ecosystem. -Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem Ecological succession. - Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem:

a) Forest Ecosystem
b) Grassland Ecosystem
c) Desert Ecosystem
d) Aquatic Ecosystem (Ponds, Streams, Lakes, Rivers, Oceans, Eustuaries)

MODULE - III

Biodiversity and its conservation: Introduction – Definition- genetic, species and ecosystem diversity. Bio-geographical classification of India

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India.

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

MODULE - IV
Environmental Pollution: Definition, Cause, effects and control measures of a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards
MODULE - V
Social Issues and the Environment: From unsustainable to sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, and watershed management - Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust. Case Studies. – Waste land reclamation
MODULE - VI
Human Population and the Environment: Population growth, variation among nations. Population explosion Role of information Technology in Environment and human health. - Case Studies. **Field work:** Visit to a local area to document environmental assets River /forest grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems- pond, river, hill slopes, etc.

Text books:

1. Erach Bharucha, A Text Book of Environmental Studies for Undergraduate Courses, University Grants Commission.
2. Perspectives in environmental Studies, Anubha Kaushik and C P Kaushik, New Age International Publishers, New Delhi, 2018. 2. A Textbook of Environmental Studies, Shashi Chawla, McGraw Hill Education, New Delhi, 2017.

Reference Books:

1. Environmental Studies by Benny Joseph, McGraw Hill Education, New Delhi, 2017.
2. Fundamentals of environmental studies, Mahua Basu and S Xavier, Cambridge University Press, New Delhi, 2017.

SEMESTER III

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3C1	Surveying & Geomatics	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the basic principles and different methods of surveying.	1, 5	2, 3
CO2	To learn about the various methods of chaining and computing the areas.	2, 5	2, 3
CO3	To understand the concepts related to compass traversing.	2, 5	2, 3
CO4	To learn concepts of levelling and contouring using various methods.	2, 5	2, 3
CO5	To learn about measuring horizontal & vertical angles using Theodolite and understand concepts related to Tacheometry survey.	2, 5	2, 3
CO6	To understand various elements of curves and the applications of modern surveying methods like EDM, GPS, GIS etc.	2, 5	2, 3

MODULE – I

Introduction: Introduction to surveying – objectives –Primary divisions of surveying classification of surveys – principles of surveying, Difference between plan and a map, scale of a map-engineers scale, representation fraction, graphical scale, sources of errors and types of errors, Conventional symbols.

MODULE – II

Chain surveying: Introduction to chain survey, basic definitions, principles of chain surveying, well-conditioned triangle, Instruments for chaining and taping, ranging, error due to shrinkage of a map, error due to wrong measuring scale, obstacles in chaining, chaining on uneven or sloping ground, instruments for setting out right angles.

Computation of areas - Simpson's rule, trapezoidal rule, average ordinate rule.

MODULE – III

Compass surveying: Introduction to compass surveying – Types of compasses – Types of bearings, fore bearing & back bearing, Designation of bearings – Calculation of included angles from bearings, Dip, magnetic declination, determination of true bearing– Traversing – Adjustments of prismatic compass - Local attraction – problems.

MODULE – IV

Levelling: Introduction to Levelling – Terms used in levelling – Bench mark – temporary adjustments - Height of instrument method – Rise and fall method – related problems– Reciprocal Levelling – Profile Levelling (Theory).

Contouring: Introduction to contouring – characteristics and uses – Types.

MODULE – V
Theodolite: Component parts of theodolite, temporary adjustments, measurement of horizontal and vertical angles. **Tacheometric surveying:** Principles of Tacheometry, Introduction to Stadia and tangential Tacheometry.
MODULE – VI
Curves: Types of curves and their necessity, elements of simple circular curve. **Advanced surveying:** Principle of Electronic Distance Measurement (EDM), Total Station – Parts of a Total Station – Advantages, disadvantages and Applications, Global Positioning Systems: Introduction-Advantages & disadvantages, Applications of GPS.

Student Activity: Prepare contour map of surrounding area by using suitable equipment.

Text Books:

1. Dr. K.R. Arora, Surveying Vol-1 & Vol-2, Thirteenth Edition, Standard Book House, 2015
2. Dr. B.C. Punmia, Er. Ashok K. Jain and Dr. Arun K. Jain., Surveying Vol-1 & Vol-2, Sixteenth Edition, Laxmi Publications (P) Ltd., 2005.

Reference Books:

1. R. Subramanian, Surveying and levelling, Second Edition, Oxford University press, 2012.
2. S. K. Duggal., Surveying Vol-1, Fourth edition, McGraw Hill., 2013.
3. S. S. Bhavikatti, Surveying and Levelling Vol-1, I. K. International Publishing House Pvt. Ltd., 2008.
4. Surveying and Levelling by N. N. Basak

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3C2	Fluid Mechanics & Hydraulic Machines	3	1	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain knowledge on fluids properties, their pressures and concepts of buoyant forces.	1, 2, 3	3, 4
CO2	To understand concepts related to fluid kinematics & dynamics.	1, 2, 4	3, 4
CO3	To analyse the measurement of flows through pipes and their losses.	1, 2, 4	3, 4
CO4	To know about the impact of various forces of jets in various types of plates.	1, 2, 4	3, 4
CO5	To analyse the work done and efficiencies of hydraulic turbines.	1, 2, 3	3, 4
CO6	To understand about the efficiencies of centrifugal and Reciprocating pumps.	1, 2, 3	3, 4

MODULE – I

Fluid Statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, surface tension - vapour pressure - Newtonian and non-Newtonian fluids. Fluid Pressure at a Point; Pascal's law, Atmospheric gauge and vacuum pressure – measurement of pressure using manometer - Piezometer, U-tube, and differential manometers.

Hydrostatic Forces on Surfaces: Total Pressure and Centre of Pressure: on Horizontal Plane Surface; Vertical Plane Surface; Inclined Plane Surface and Curved Surfaces.

Buoyancy: Buoyancy; Buoyant Force and Centre of Buoyancy, conditions of equilibrium of submerged and floating bodies; Meta centre and meta centric height, analytical method for metacentric height. (Simple Numerical Problems).

MODULE – II

Fluid Kinematics: Streamline, path line, streak lines and stream tube, steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, rotational and irrotational flows - equation of continuity for one dimensional flow.

Fluid Dynamics: Equations of Motion – Euler's equation - Bernoulli's equations - Momentum equation for the force exerted by a flowing fluid on the pipe bend. (Simple Numerical Problems).

MODULE – III

Measurement of Flow: Pitot tube, venturimeter, and orifice meter.

Flow through pipes: Reynold's experiment - Darcy Welsbach equation - Minor losses in pipes- pipes in series and pipes in parallel, total energy line - hydraulic gradient line. (Simple Numerical Problems).

MODULE – IV

Impact of Jets: Force Exerted by the Jet on a Stationary Vertical plate, Inclined Flat Plate and Curved Plate

- Jet striking at centre and tangentially at one end when the plate is symmetrical and unsymmetrical. Force Exerted by the Jet on a moving Vertical plate, Inclined Flat Plate and Curved Plate - Jet striking at centre and tangentially at one end when the plate is symmetrical and unsymmetrical. Force exerted on a series of radical curved vanes. (Simple Numerical Problems).
MODULE – V
Hydraulic Turbines: Classification of turbines - impulse and reaction turbines - Pelton wheel - Francis turbine and Kaplan turbine - work done & efficiencies. Specific Speed - Unit Speed – Unit Discharge - Unit Power – selection of turbines. (Simple Numerical Problems).
MODULE – VI
Centrifugal Pumps: Construction, work done – Definitions of suction, delivery, static and manometric heads. Definitions of manometric & mechanical Efficiencies of a Centrifugal Pump, NPSH. **Reciprocating Pumps:** Construction, work done, Discharge, slip of Reciprocating Pumps, Comparison between Centrifugal Pumps and Reciprocating Pumps. (Simple Numerical Problems).

Students Activity: Study of water flows and capacities in irrigation canals and dams.

Text books:

1. Hydraulics, fluid mechanics and Hydraulic machinery, by Dr. P.N. Modi and Dr S.M. Seth
2. Hydraulics, fluid mechanics and Hydraulic machinery, by RK Bansal

Reference books:

1. Fluid Mechanics and Hydraulic Machines, by Rajput :Chand (S.) & Co Ltd, India,
2. Fluid Mechanics and Fluid Power Engineering, by D.S. Kumar: Kotaria& Sons.
3. Fluid Mechanics and Machinery by D. Rama Durgaiah: New Age International. Hydraulic Machines by Banga& Sharma: Khanna Publishers

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3C3	Strength of Materials	3	1	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To learn about the basic concepts of simple stresses & strains.	1, 2, 3	3, 4
CO2	To learn about concepts of principal planes & stresses and maximum shear stresses.	1, 2, 4	3, 4
CO3	To Draw SFD & BMD of various beams.	1, 2, 4	3, 4
CO4	To determine the bending and shear stresses among various sections.	1, 2, 4	3, 4
CO5	To solve various problems related to torsion of shafts and deflection in springs.	1, 2, 4	3, 4
CO6	To analyse deflections in beams and stresses in thick & thin cylinders.	1, 2, 4	3, 4

MODULE – I

Simple Stresses and Strains: Concept of stress and strain, Types of stresses and strains, stress – strain diagram for mild steel, Elasticity and plasticity, Hooke‘s law, Elastic constants and their relationship, Working stress – Factor of safety – Lateral strain, Poisson‘s ratio, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self- weight, Bars of varying section – composite bars – Temperature stresses (Simple Numerical problems only). Strain energy – Resilience.

MODULE – II

Complex Stress and Strains: plane stress, plane strain, state of simple shear or pure shear, Stresses on inclined planes, concept of principal planes and principal stresses, maximum shear stress, mohr‘s circle of stresses.

MODULE – III

Shear Force and Bending Moment in Beams: Definition of beam – Types of beams, supports and loads – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load uniformly varying loads and combination of these loads – Point of contra flexure.

MODULE – IV

Theory of simple bending & shear stresses in beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, Neutral axis –Determination of bending stresses - Section modulus of rectangular and circular sections. Derivation of formula Shear stress distribution across various beam sections like rectangular, circular, I, T, angle sections.

MODULE – V

Torsion of circular shafts & springs: Theory of Torsion and its assumptions, Derivation of Torsion equations –Torsional moment of resistance, Polar section modulus – combined bending moment and torsion of shafts – Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.

MODULE – VI

Deflection of Beams: Elastic curve – Governing differential equation – Macaulay's method – Area moment method – conjugate beam method for computation of slope and deflection of determinant beams.

Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure, radial and hoop stress distribution.

Students Activity: Analysis of various forces and stresses on elements suggested by the faculty

Text Books:

1. Mechanics of Materials – Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
2. Strength of Materials by R. Subramaniyan, Oxford University Press.
3. Strength of Materials by Dr. R. K. Bansal, Lakshmi Publications.
4. Strength of Materials: (Mechanics Of Solids) Paperback by R K Rajput, S. Chand Publications

Reference Books:

1. S. Timoshenko, D.H. Young and J.V. Rao, "Engineering Mechanics", Tata McGrawHill Company.
2. Sadhu Singh, "Strength of Materials", 11th edition 2015, Khanna Publishers
3. S.S.Bhavikatti, "Strength of materials", Vikas publishing house Pvt. Ltd
4. R.S. Khurmi and N. Khurmi, A text book of "Strength of Materials" "(Mechanics of Solids)", S Chand and Company Limited, Ramnagar, New Delhi-110 055

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3C4	Remote sensing and GIS	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know about aerial photographs, to determine parallax measurements for heights.	1, 5, 12	2
CO2	To know about basic concepts of remote sensing, sensors & types, elements involved and related terminologies.	1, 5, 12	2
CO3	To know about the categories & theoretical framework of GIS.	1, 5, 12	2
CO4	To understand the procedures of collection and Storage of data & input overview.	1, 5, 12	2
CO5	To understand the analysis of GIS spatial data.	1, 5, 12	2
CO6	To understand and know the applications of GIS in various fields.	1, 5, 12	2

MODULE – I

Introduction to Photogrammetry: Principles & types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

MODULE – II

Remote Sensing: Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

MODULE – III

Geographic Information System: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. spatial data, raster data models, vector data models, raster versus vector, data input methods and editing, non-spatial data, map projections.

MODULE – IV

Types of Data Representation: Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

MODULE – V

GIS Spatial Analysis: Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

MODULE – VI
Water Resources Applications of GIS: Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development and Watershed characteristics. Reservoir sedimentation, Fluvial Geomorphology, water resources management and monitoring, Ground Water Targeting, Identification of sites for artificial Recharge structures, Drainage Morphometry, Inland water quality survey and management, water depth estimation and bathymetry.

Students Activity: Study and report applications of GIS & RS in various fields, Case studies on usage of RS & GIS.

Text Books:

1. Remote sensing and GIS by M. Anjireddy ,B.S. Publications, New Delhi.
2. Remote Sensing and GIS by B.Bhatta, Oxford University Press,New Delhi.
3. Advanced surveying : Total station GIS and remote sensing – SatheeshGopi – Pearson publication
4. Geographical Information Science by Narayana Panigrahi, University press,New Delhi
5. GIS by Kang – tsungchang, TMH Publications & Co.,
6. Principals of Geo physical Information Systems – Peter A Burragh and Rachael Mc Donnell, Oxford Publishers 2004

Reference Books:

1. Concepts & Techniques of GIS by C.P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications.
3. The GIS book by Korte, cengage publications, New Delhi.
4. Fundamental of GIS by Mechanical designs John Wiley & Sons.
5. Remote Sensing and its applications by LRA Narayana University Press 1999.
6. Geoinformation for Development by Zeil/Kienberger (Eds) – Univ.Science Press, New Delhi

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3C5	Advanced Construction Techniques	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the advanced techniques related to substructure.	1, 3, 5	1, 2
CO2	To understand the concepts of the superstructure execution.	1, 3, 5	1, 2
CO3	To understand updated techniques in construction industry.	1, 3, 5	1, 2
CO4	To identify the problem and solve with necessary repairs to the structure.	1, 3, 5	1, 2
CO5	To understand the various floor and sub-grade strengthening techniques.	1, 3, 5	1, 2
CO6	To understand the nuances of demolition and dismantling techniques.	1, 3, 5	1, 2

MODULE – I

Sub Structure Construction: Box Jacking -pipe jacking - diaphragm walls types and methods – piling techniques - driving well and caisson – sheet piles – construction procedures and applications-cofferdam - methods -cable anchoring and grouting - dewatering and stand by plant equipment for underground open excavation.

MODULE – II

Tall Structures Construction: Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections launching techniques -Slip form techniques suspended form work -erection techniques of tall structures, large span structures, tubular constructions, shear wall construction and outrigger structures.

MODULE – III

Large Span Structures Construction: Types of bridges and loading standards Bow string bridges, cable stayed bridges. Construction aspects and inspection and maintenance of bridges. Launching and pushing of box decks. Construction sequence and methods in domes and pre-stressed domes – various construction techniques of domes –methods-merits and demerits.

MODULE – IV

Special Structure Construction: Erection of lattice towers and rigging of transmission line structures – construction procedures of cooling towers, silos, chimney. Advanced construction techniques in offshore construction practice- Vacuum dewatering of concrete flooring – white topping –methods and application-erection of articulated structures, floating structures-methods.

MODULE – V

Common Strengthening Techniques: Mud Jacking grout through slab foundation - micro piling for strengthening floor and shallow profile pipeline laying - protecting sheet plies, screw anchors – sub grade water proofing -under pinning.

MODULE – VI

Demolition And Dismantling: Demolition Techniques, Demolition by Machines, Demolition by

Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

Students Activity: Student must prepare a report on any one advanced construction technique other than the prescribed techniques in the syllabus.

Text Books

1. Roy Chudley, Roger Geeno ,"Advanced Construction Technology" Latest Edition, 2005.
2. Ponnuswamy .S,"Bridge Engineering "Second Edition, 2008.

Reference Books:

1. Sankar .S.K. And Saraswati .S, Construction Technology, Oxford University Press, New Delhi, 2008.
2. Gahlot .P.S & Sanjay Sharma,"Building repair and maintenance management" , CBS Publications.2006.
3. Robertwade Brown, "Practical Foundation Engineering Hand Book", Mcgraw Hill Publications, 2005.
4. Patrick Powers .J, "Construction Dewatering: New Methods And Applications", John Wiley & Sons, 2002.
5. Micheal T.Kubal ,"Construction Waterproofing Handbook".

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	**CT21B3C6**	**Construction Planning and Management**	**4**	**0**	**0**	**4**	**50**	**50**	**100**

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand various basic concepts involved in Project planning and related terminologies.	8,11	2
CO2	To plan the construction project activities using various planning techniques.	1,11	2, 3
CO3	To know the basic concepts related to project scheduling and resources levelling & allocation.	1,11	2, 3
CO4	To understand the schedule and cost controls of the project.	1,11	2, 3
CO5	To optimise and manage the cost and duration of the project	1,11	2, 3
CO6	To understand the basic concepts related to human resource planning and applications.	8, 11	2

MODULE - I

Construction planning: Introduction, types of project plans, time plan, manpower plan, material plan, construction equipment plan, finance plan, work-breakdown structure, methodology of WBS, planning techniques—terminologies used, event and activity, dummy activity, network, precedence, network logic, duration of an activity, forward and backward pass, float or slack time.

MODULE - II

Planning Techniques: Path and critical path, bar charts, reparation of network diagram, Programme Evaluation And Review Technique (PERT), Critical Path Method (CPM), the Line-Of-Balance (LOB), network techniques advantages, disadvantages.

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation.

MODULE – III

Project scheduling: Introduction- resource levelling- resource allocation, importance of project scheduling, Introduction to various schedules derived from project - schedules, preparing invoice schedule. schedule of milestone events, schedule of plant and equipment, schedule of project staff, schedule of labour requirement, schedule of materials requirement, schedule of specialized agencies, schedule of direct costs, schedule of overheads, schedule of cash inflow, schedule of cash outflow.

MODULE - IV

Project Control- Schedule/time/progress control, monthly progress report, measuring progress at site, typical reports to aid the progress review, cost control, profit/loss at the completion of contract, stage-wise completion of cost, standard costing, s-curve, unit costing.

MODULE - V
Project Cost Model: Project cost, Indirect project cost, direct project cost, slope of the direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization, steps in cost-time optimization.
MODULE - VI
Human Resource Planning: Process of Human Resource Planning, Need for Human Resource Planning, HR Forecasting Techniques, Successful Human Resource Planning. Recruitment and Selection: Concept of Recruitment, Factors Affecting Recruitment, Sources of Recruitment, Recruitment Policy, Selection, Selection Process, Interviews, Induction.

Students Activity: Student must prepare a detailed report on a cost model of any project.

Text Books:

1. Project Management-Planning and Control---Rory Burkey 4th ed.—Wiley, India
2. Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson,2012
3. Construction Project Management Planning, Scheduling and Controlling-Chitakara- Tata McGraw Hill, New Delhi
4. Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication.
5. Construction Planning & management By P S Gahlot & B M Dhir , New Age International Limited Publishers

Reference Books:

1. Tenah, K.A. (1985). "The Construction Management Process" Reston Publishing Company, Inc. Virginia, USA.
2. Roy Pilcher (1985) ―Project Cost Control in Construction,‖ Collins Professional and technical books, London.
3. Raina, C.M. ―Construction Management and Practice.‖ Tata McGraw-Hill, New Delhi, 1980.
4. Construction Project planning & Scheduling By Charles Patrick, Pearson, 2012
5. Construction management Fundamantals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition,
6. Project Management – K Nagrajan – New age International Ltd.
7. Professional Construction Management Barrie-Paulson-McGraw Hill Institute Edition.
8. Project Management – Ahuja H.N. – John Wiely, New York.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3P1	Construction Materials Testing Laboratory	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To test various mechanical properties of Mild Steel.	4, 9, 10	3, 4, 5
CO2	To test various mechanical and durability properties of Bricks.	4, 9, 10	3, 4, 5
CO3	To test mechanical properties of cement.	4, 9, 10	3, 4, 5

	Part- A
1.	Tension test on structural materials-mild steel and HYSD bars.
2.	Compression test on structural materials Timber.
3.	Impact Test on structural materials-mild steel (IZOD and CHARPY).
4.	Torsion test on structural materials-mild steel and HYSD bars.
5.	Hardness test on Steel (Rockwell and Brinell).
	Part – B
6.	Bricks
a)	Efflorescence test of brick
b)	Determination of water absorption of brick
c)	Determination of compressive strength of brick
7.	Strength tests on Tiles
	Part – C
Tests on cement	
8.	Normal Consistency and fineness of cement.
9.	Initial setting time and final setting time of cement.
10.	Soundness of cement
11.	Specific gravity of cement
12.	Compressive strength of cement

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3P2	Surveying Laboratory	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To measure long distances using appropriate surveying techniques.	4, 9, 10	3, 4, 5
CO2	To measure horizontal and vertical angles between two points.	4, 9, 10	3, 4, 5
CO3	To calculate areas enclosed between various points.	4, 9, 10	3, 4, 5
CO4	To calculate level differences in a particular area.	4, 9, 10	3, 4, 5

1. Chaining a line involving Indirect Ranging.
2. Calculation the area of a given parcel of land by cross staff survey using chain surveying.
3. Chaining across obstacles.
4. Study of the component parts of Prismatic compass and also its temporary adjustments.
5. Calculation of included angles from the observed bearings.
6. Surveying of a given area by prismatic compass (Open traverse).
7. Surveying of a given area by prismatic compass (Closed traverse).
8. Study of the component parts of Dumpy Level and also its temporary adjustments.
9. Calculate the reduced level of points by rise and fall method using dumpy level.
10. Calculate the reduced level of points by Height of Instrument method using dumpy level.
11. Study of the component parts of Theodolite and also its temporary adjustments.
12. Measurement of horizontal angle by repetition method with theodolite.
13. Measurement of horizontal angles by reiteration method with theodolite.
14. Measurement of Vertical angles with theodolite.
15. Study of the Total Station equipment along with its component parts.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
III	CT21B3K1	Skill/Job Oriented Course-01	0	2	0	2	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the importance and relevance of various site activities and will be able to relate the technical knowledge.	9, 10	3

Construction Site Visit

The student must visit an ongoing construction site and prepare a brief report on:

1. Structural elements in buildings
2. Safety Provisions for workers
3. Quality practices
4. Equipment used
5. Miscellaneous

Note:

1. The Departmental head will allot a course instructor at the starting of III semester.
2. The course instructor allotted by the department head should award marks to the students based on the internal assessment such as submissions, performance, viva voce, Report etc.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
III	MC21B301	Indian Constitution	2	0	0	0	-	-	-

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Know the background of the present constitution of India.	6, 8, 12	1, 2
CO2	To Understand the working of the union, state and local levels.	6, 8, 12	1, 2
CO3	To Gain consciousness on the fundamental rights and duties.	6, 8, 12	1, 2
CO4	To understand the functioning and distribution of financial resources between the centre and states.	6, 8, 12	1, 2
CO5	Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democratic way.	6, 8, 12	1, 2
CO6	To understand the international relations of India with the surrounding countries.	6, 8, 12	1, 2

MODULE - I

Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.

MODULE - II

Union Government: Executive-President, Prime Minister, Council of Minister
State Government: Executive: Governor, Chief Minister, Council of Minister
Local Government: Panchayat Raj Institutions, Urban Government

MODULE - III

Rights and Duties: Fundamental Rights, Directive principles of state policy, Fundamental Duties

MODULE - IV

Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India

MODULE - V

Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

MODULE - VI

India's External Relations: Cold War and Post-Cold War era.What is Foreign Policy? Basic Determinates of Foreign Policy Indian and its Neighbours India's Extended Neighbourhood in West Asia and South East Asia. India's relations with the United States and Russia. India and the World Organisations India in the 21st century

Reference Books:

1. D.D. Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi
2. Subhash Kashyap, Our Parliament, National Book Trust, New Delhi
3. Peu Ghosh, Indian Government &Politics, Prentice Hall of India, New Delhi
4. B.Z. Fadia & Kuldeep Fadia, Indian Government &Politics, Lexis Nexis, New Delhi

SEMESTER IV

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4C1	Structural Analysis	3	1	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To determine determinate & indeterminate of structure, Determinacies of frames and energy principles.	2, 3, 4	3, 4
CO2	To analyse the Static & kinematic indeterminacies of fixed and continuous beams.	2, 3, 4	3, 4
CO3	To analyse continuous beams by slope-deflection method with & without sinking of supports, with & without sway forces.	2, 3, 4	3, 4
CO4	To analyse continuous beams by moment distribution method with & without sinking of supports, with & without sway forces.	2, 3, 4	3, 4
CO5	To analyse continuous beams with settlement of supports by using Kani's methods.	2, 3, 4	3, 4
CO6	To analyse the plastic analysis of statically indeterminate structures.	2, 3, 4	3, 4

MODULE – I

Static and Kinematic indeterminacy: Classification of structures, determinate and indeterminate structure, Determination of static and kinematic indeterminacy of trusses, pin jointed and rigid jointed frames.

Energy principles: Strain energy due to axial load and bending moment, Castigliano's first & second theorem.

MODULE – II

Fixed and Continuous beams: Static and kinematic indeterminacy beams with uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – Shear force and Bending moment diagrams.

MODULE – III

Slope Deflection method: Introduction, Analysis of continuous beams with and without sinking of supports, single bay single storey portal frames with and without side sway-shear force and bending moment diagrams.

MODULE – IV

Moment distribution method: Stiffness, Distribution factor, carry over moment and carry over factors – Analysis of continuous beams with and without sinking of supports, single bay single storey portal frames with and without side sway - shear force and bending moment diagrams.

MODULE – V
Kani`s Method: Analysis of continuous beams – including settlement of supports and single bay, single storey portal frames with side sway by Kani's method.
MODULE – VI
Plastic Analysis: Introduction – Idealized stress – Strain diagram – shape factors for various sections – Moment curvature relationship – ultimate moment – Plastic hinge – lower and upper bound theorems – ultimate strength of fixed and continuous beams.

Students Activity: Analyze various continuous beams and portal frames using various methods

Text Books:

1. Bhavikatti, S.S, Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt.Ltd., New Delhi-4.
2. Analysis of Structures – Vol-I&II by V.N.Vazirani & M.M.Ratwani, Khanna Publications, New Delhi.
3. Pandit G.S.and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd.

Reference Books:

1. Theory of structures by Ramamuratham, jain book depot , New Delhi.
2. Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi.
3. Structural Analysis by C.S. Reddy, Tata Mc graw hill, New Delhi
4. Structural analysis – Hibbler, 6th edition – Pearson publication

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4C2	Transportation Engineering	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the basics of highway planning, road patterns, alignment and surveys involved.	4, 7, 11	3
CO2	To understand the basic elements in design of roads and design of horizontal and vertical alignments.	4, 7, 11	3
CO3	To acquire the knowledge on various concepts related to traffic engineering and methods of collecting traffic data.	4, 7, 11	3
CO4	To understand about Highway Maintenance and various types of pavements and their functions.	4, 7, 11	3, 4
CO5	To gain the basic knowledge of railway geometric design.	4, 7, 11	3
CO6	To gain knowledge on basic concepts of airport engineering.	4, 7, 11	3

MODULE – I

Highway Development, Planning, Alignment & Surveys: Highway development in India – Significance of highway planning, Classification of roads, Road patterns, Highway alignment and its basic requirements, factors controlling highway alignment, Engineering surveys for highway alignment.

MODULE – II

Geometric Design of Highway: Importance of Geometric Design- Design Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

MODULE – III

Traffic Engineering & Management: Basic Parameters of Traffic–Volume, Speed, Density and their relation, Traffic Volume Studies– Speed Studies, speed and delay studies, origin & destination studies, intersection delay studies, parking studies, accident studies. Traffic Signs and Road Markings - Traffic Signals – Webster Method - Traffic Islands, channelization, Rotary Intersection – Design criteria - Advantages and Disadvantages of Rotary Intersection.

MODULE – IV

Highway Maintenance: Need for Highway Maintenance, Pavement Failures - Failures in Flexible Pavements - Types and Causes - Rigid Pavement Failures - Types and causes - Pavement Evaluation, Benkelman Beam method, FWD - Strengthening of Existing Pavements - Types of Overlays, Suitability.

Pavement Design: Flexible and Rigid Pavements – Components and Functions. Differences between flexible and rigid pavements and the factors considered for designing flexible and rigid pavements. Design procedure of CBR Method.

MODULE – V
Railway Engineering & Geometric Design: Geometric design of Railway track, Speed and cant, Cross Section of Permanent Way, Functions of various Components like Rails, Sleepers and Ballast, Rail Fastenings, Concept of Gauges, Gradients, Coning of Wheels and its advantages, Creep of rails, super elevation, Transition Curves, Points and Crossings- Layout And Functioning Of Left Hand Turn Out And Right Hand Turn Outs.
MODULE – VI
Airport Engineering: Airport Site Selection – Factors Affecting Site Selection And Surveys- Runways – Wind Rose Diagram – Basic Runway Length – Correction For Runway Length – Terminal Area – Layout And Functions – Concepts Of Terminal Building.

Student Activity: Study and report the failures of pavement designs with solution and also unique designs to control traffic.

Text Books:

1. S. K. Khanna, C. E. G. Justo, and A. Veeraragavan, Highway Engineering, Revised 10th Edition, Nemchand& Bros., New Delhi.
2. Railway Engineering by Rangwala, 25th edition, Charotar publishing house private limited, Anand, India.
3. Harbour, Dock & Tunnel Engineering- R. Srinivasan; Charotar Publishers, Ahmedabad.

Reference Books:

1. L. R. Kadiyali and Lal, “Principles and Practice of Highway Engineering Design”, Khanna Publications.
2. Planning & Design of Airports – Robert Horonjeff, Francis McKelvey; Tata Mc Grawhill.
3. Railway Engineering 2nd Edition - Satish Chandra & M. M. Agarwal; Oxford University Press-New Delhi
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
5. Airport Planning and Design - S. K. Khanna, M. G. Arora & S. S. Jain; Nem Chand & Bros,

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4C3	Building Services	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the necessity, functions of ventilators and types of lighting used for building.	6, 7, 11	2
CO2	To understand lift and escalator design considerations, location, sizes, landing and other components.	6, 7, 11	2
CO3	To know about plumbing services for water & drainage and maintenance.	6, 7, 11	2
CO4	To know about the principles of green buildings and energy conservation in buildings with different techniques & methods.	6, 7, 11	2
CO5	To gain knowledge on various refrigerator systems, air conditioning units, principles of VCR, VAR, ducting systems.	6, 7, 11	2
CO6	To know about fire safety systems like sprinklers, dryers & other technologies.	6, 7, 11	2

MODULE – I

BASIC INFRASTRUCTURE SERVICES:

Ventilation: Necessity – Functional requirements – Natural and mechanical ventilation.

Lighting: Day and artificial lighting – Types of lighting in working places.

Fundamentals of building acoustics: Quality indicators, Acoustic materials, Noise control.

MODULE – II

Lift: Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts - Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push.

Escalator: Necessity, Components of a typical escalator, working principle, design considerations.

MODULE – III

Plumbing Services: Water supply system- fixing of pipes in buildings – maintenance of buildings water meters - sanitary fittings - design of building drainage - gas supply systems. Understanding and representing the plumbing services for a building in the form of diagrams.

MODULE – IV

Introduction to Green Buildings: Definition of green buildings and sustainable development, Principles of green buildings, Eco-friendly materials, green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

Energy conservation in buildings - Necessity - Advantages and Limitations - Introduction to Zero Energy Buildings& Green Buildings - Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation.

MODULE – V
Basic of HVAC: Terminology of Refrigeration & Air Conditioning, units of refrigeration, performance of a refrigerator / heat pump, refrigerants, desirable properties of refrigerants, Principle of VCR and VAR, psychometrics properties, psychometric chart, Humidification and dehumidification process, Requirements of comfort Air Conditioning, Ducting – Different types of ventilation system.
MODULE – VI
Fire Safety in Buildings: Fire, causes of fire and spread of fire, fire fighting, protection & fire resistance, equipment & methods of fighting fire, Code of fire safety, fire regulations, fire insurance, combustibility of materials. Structural elements and fire resistance **Electrical Systems in Built - Environment -** Electricity distribution in buildings, Service wires, meter boards, circuits, switch boards, electrical safety devices in buildings, MCBs, Earthing. Identifying various components and representation of these components by symbols.

Students Activity: Study about fire safety regulations given by government, Study about functions, necessity & provision of proper ventilation, Study & report researches about not providing proper ventilation and issues that arises.

Text Books:

1. Building Services & Equipment, Fred Hall, Longman Scientific and Technical.
2. Building Services, Technology and Design, Roger Greeno, Longman Scientific and Technical.
3. Maintenance of Buildings by A.C. Panchadari, New Age International (P) limited Publishers
4. National Building Code of India, Bureau of Indian Standards, 2005.

Reference Books:

1. Building Maintenance Management, Chanter, Wiley India
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Fire safety in Buildings by Jain, New age Pubilishers.
4. Building Construction, Arora and Bindra, Dhanpat Rai, 2012.
5. Electrical & Mechanical Services In High Rise Buildings Design & Estimation Manual by Ak Mittal, CBS Pubilishers.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4C4	Construction Economics and Finance	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand basic concepts related to construction Economics.	1, 2, 11	2, 3
CO2	To gain knowledge on value engineering application in construction sector.	1, 2, 11	2, 3
CO3	To understand Infrastructure Developments in construction Sector.	1, 2, 11	2, 3
CO4	To know different types of market structure in the construction industry.	1, 2, 11	2, 3
CO5	To gain knowledge on engineering economics and types of financing.	1, 2, 11	2, 3
CO6	To understand various principles and management of construction accounts.	1, 2, 11	2, 3

MODULE – I

Construction Economics: Introduction, Economic Decision Making - Out-of-Pocket Commitment, Payback Period Average Annual Rate of Return, Time Value Of Money, Cash-Flow Diagrams - Project Cash-Flow And Company Cash-Flow Diagrams, Using Cash-Flow Diagrams Using Interest Tables Evaluating Alternatives By Equivalence- Present worth Comparison Future worth Comparison Annual Cost and worth Comparison Rate of Return Method.

MODULE – II

Value Management in Construction: Steps in the application of value engineering, Description of the case, Value-engineering application in the case project - Foundation Design - Flooring System - Precast vs in-situ Construction - Discussion of Results.

MODULE – III

Construction Infrastructure and Development: Role of Civil Engineering in Industrial Development, Construction development in Housing, transport and other infrastructures, Economics of ecology, environment, energy resources. Construction workers - Urban Problems, Poverty, Unemployment Effects on economics due to migration of construction workers to urban area.

MODULE – IV

Market Structure in Construction: Clients & contractors, partnering, costs of construction firm, production decisions, diminishing returns, short-run costs, contractor's costs, long-run costs, external economics of scale, types of market structure in the construction industry.

MODULE – V

Engineering Economics: Breakeven analysis, replacement analysis, evaluation of alternatives, benefit cost ratio analysis.

Capital Structure: The need for financial management, Types of financing - short term borrowing, long term borrowing, leasing, equity financing – Internal generation of funds, External commercial borrowings, Assistance from government budgeting support and international finance corporations.

MODULE – VI

Construction Accounts Management: Principles of accounting, accounting process, construction contract

revenue recognition, Cash method of revenue recognition, straight accrual method of revenue recognition, completed contract method of revenue recognition, percentage of completion method of revenue recognition. Limitations of accounting, balance sheet, profit and loss account. Working capital - components of working capital, financing sources of working capital. Ratio analysis - liquidity ratios, capital structure ratios, profitability ratios, activity ratios, supplementary ratios.

Student Activity: Preparation of Cash Flow Statement for a Sample Project.

Text Books:

1. Urban Economics by Warneer Z Hirsch, Macmillan, New York
2. P. Saravanavelu, "Management Accounting - Principles and Practice
3. Construction project management theory and practice, Second edition Kumar neeraj jha
4. Management Accounting Principles And Practice by Neeti Gupta Shashi K Gupta, Rk Sharma,

Reference Books:

1. Financial Management, I.M. Pandey.
2. Prof. K.S. Nagapathi "Management Accounting", R. Chand & Co., New Delhi

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4C5	Advanced Concrete Technology	3	0	0	3	50	50	100

Cos	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Understand various constituents of concrete like cement, aggregates and admixtures.	1, 3, 5	2
CO2	To know the properties and various tests on Fresh concrete.	1, 3, 5	2
CO3	To know the properties and various tests on Hardened concrete.	1, 3, 5	2, 3
CO4	To understand the basic concepts of Elasticity, Creep & Shrinkage and Durability of concrete.	1, 3, 5	2, 3
CO5	To design mix proportions for different types of concrete.	1, 3, 5	2, 3
CO6	To gain knowledge on different special concretes and their behaviour.	1, 3, 5	2

MODULE – I

Constituents of concrete:

Cement: Cement- Chemical composition and their importance, Hydration of cement, structure of hydrated cement, Importance of Bogue's compounds, various types of cement and uses, testing of cement as per Indian standard.

Aggregates: Aggregates - classification of aggregate – tests on properties of aggregates - characteristics of aggregate - I.S. Specifications.

Admixtures: Mineral admixture - Fly ash, silica fume, ggbs, and other pozzolanic materials. Chemical admixtures - Accelerator, retarder, water reducing elements, plasticizer and super-plasticizer, their functions and dosage - I.S. Specifications

MODULE – II

Fresh Concrete: Properties of fresh concrete, workability - factors influencing workability- measurement of workability for conventional concrete (Slump Cone, Compaction Factor and Vee-Bee test), Segregation and bleeding, Process of manufacturing of concrete - Batching, Mixing, Transporting, Placing and Compaction.

Curing - necessity and various methods.

MODULE – III

Hardened Concrete: Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Abram's Law, Relation between compressive & tensile strength

Tests on hardened concrete: Principal, applications and limitations of following tests Destructive Tests- Compression, Split Tensile and Flexural Semi Destructive Tests and Pull out test Non Destructive Tests - Rebound Hammer-Ultra sonic Pulse velocity.

MODULE – IV
Elasticity, Creep & Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Posisson‘s ratio – Creep of concrete –Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage - Factors affecting the shrinkage. **Durability of concrete:** Definition and significance of durability, Factors affecting durability- Sulphate attack, chloride attack, carbonation, Degradation by freezing and thawing. Corrosion induced cracking and its control methods, Alkali Aggregate Reaction, IS456-2000 requirement for durability.
MODULE – V
Mix Design: Principles of concrete mix design, concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Sampling and acceptance criteria Procedure of mix proportioning. Design mix Proportioning using IS-10262:2019 & ACI method.
MODULE – VI
Special concretes: Polymer concrete - Applications, Fiber reinforced Concrete - Different types of fibers and Applications, Slurry-infiltrated fiber reinforced concrete (SIFCON) & its applications, Ferro cement concrete and applications, Self-compacted concrete & its applications. Permeable concrete & its applications, High density concrete and high-performance concrete & applications, bacterial concrete & its applications, Self-compacting concrete & its applications, shotcrete.

Students Activity: Calculate mix design for various local materials

Text Books:

1. Properties of Concrete by A.M. Neville, ELBS publications.
2. Concrete: Micro Structure, Properties and Materials by P.K.Mehta, Tata McGraw Hill Publishing House Pvt. Ltd

Reference Books:

1. Concrete Technology by A.K. Santhakumar, Oxford Press.
2. Concrete Technology by M.S. Shetty, S.Chand& Co.
3. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw HillPublishers, New Delhi

PROFESSIONAL ELECTIVE - 01

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4E1	Environmental Engineering	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To forecast population using various methods and understand the design principles of water treatment.	3, 7, 11	2, 3
CO2	To understand various filtration and chlorination techniques of water and design of waste water treatment plant	3, 7, 11	2, 3
CO3	To understand and design of the filtration and chlorination process	3, 7, 11	2, 3
CO4	To design the outline of various units in waste water treatment plant	3, 7, 11	2, 3
CO5	To understand the concept sewage collection and decomposition and solid waste management	3, 7, 11	2, 3
CO6	To identify the types of pollutants and control measure for noise pollution	3, 7, 11	2, 3

MODULE - I

Introduction: Protected water supply – Population forecasts, design period – water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards - Waterborne diseases - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

MODULE - II

Water treatment: sedimentation – principles – design factors – coagulation flocculation clarifier design – coagulants – feeding arrangements.

MODULE - III

Filtration And Chlorination: Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation comparison of filters – disinfection – theory of chlorination, chlorine demand, and other disinfection practices- Miscellaneous treatment methods.

MODULE - IV

Waste water treatment: Layout and general outline of various units in a waste water treatment plant – primary treatment design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – biological treatment – trickling filters – standard and high rate – Construction and design of Oxidation ponds.

MODULE - V

Waste water collection and characteristics: Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow – characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. – C.O.D. equations.

Solid Waste Management: Disposal of Solid Wastes- Composting- land filling incineration- Biogas plants

- Rural health - Other specific issues and problems encountered in rural sanitation. - Sewage treatment plant.- Construction & working principle of septic & IMHOFF tanks.
MODULE - VI
Pollutants: Types of Pollutants, sources and impacts, Air pollution control Air quality standards, air Quality index and limits. **Introduction to noise:** Difference between sound and noise, Pitch and Frequency, Sound Pressure, Sound Pressure level (Decibel), sources of noise and harmful effects of noise, noise measurement and noise control measures.

Student Activity: Design of Septic tank, Water Treatment plant and local case study on solid waste management plant.

Text books:

1. S. K Garg: "Water Supply Engineering," (Chapters 1-3), Khanna Publishers, Delhi, 26th Edition, 2012, ISBN: 978-8174091208.
2. E.William: "Steel, Water Supply and Sewerage", (Chapters 4,5), McGraw-Hill
3. Publishers, Delhi, 28th Edition, 2011, ISBN: 978-0471523772.
4. "Water Treatment and Sanitation Simple Method for Rural Area" by Mann H.T. and Williamson D

References:

1. Operation and maintenance of rural water supply and sanitation systems by Brikke F
2. Water Supply for Rural Areas & Small Communities by Wanger EG and Lanoix J.N.,
3. WHO "Water Supply and Sewerage", by E.W. Steel & TJ Meghee, MeGraw Hill.
4. "Manual on Water Supply and Treatment", CPHEEO. Ministry of Urban Development Govt. of India.
5. Environmental Engineering" by D. Srinivasan, PHI Learning Pvt. Ltd. 2009.
6. Metcalf & Eddy. Wastewater Engineering Treatment and Reuse". MeGraw Hill Education Pvt. Ltd. (India) Noida.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4E2	Architecture and Town planning	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know the history of architecture of egypt, greek, roman & how they influenced other countries	1,6	2
CO2	To gain the knowledge on Indian culture, architecture of various places from ancient times	1,6	2
CO3	To know the principles & elements of designing & composition	1,6	2,3
CO4	To know about various architects & their contributions in India & western countries	1,6	2,3
CO5	To gain the knowledge on systems followed by ancient Indians in their day to day life.	1,6	2,3
CO6	To know the components of planning & will be able to do basic designing	1,6	2,3

MODULE – I

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures; influences - Comparative Analysis Orders.

MODULE – II

Indian Architecture: Vedic age - Indus Valley civilization - Buddhist period; stambas, Slenstas. Roranas, Chaityans, Viharas with one example for each Hindu temples - Evaluation of Dravidian and Indo Aryan Styles - Principle factors. Temple of Aibole, Mahabalipuram, Madurai, Deograph, Bhuvaneshwar, Mount Abu. Indo - Sarsanic Architecture; Mosque - Place- Fort Tomb.

MODULE – III

Architectural Design:

a) Principle of designing : Composition of plan Relationship between plan and elevation elements, form, surface Mass, Texture, Color, Tone.

b) Principle of Compositions: Unity, contrast, proportion, scale, Bab Rhuthm, character. Principles of Planning a Residence; Site Orientation prospect, Grouping, circulation, privacy, services and other factors.

MODULE – IV

Introduction of Post-classic Architecture: Introduction of Post-classic Architecture and contribution of eminent architects to modern period. Brief summary of post - classic architecture - Indian and Western Architectural contribution of Edward Lutyens, Le Corbusier), Frank Lloyd Wrigt, Walter Groping, Vender Rohe, Caarihan, Nervi, Oscar Niemyer, Edward Durell stone.

MODULE – V

Historical Back Ground: Town planning in India - town plans of Magad - town plans of ancient Indian towns; Mourya, Pataliputra vijayanagara, Delhi.Town planning in the West-town plans of Acropolis, Rome, Paris, London.

MODULE – VI
Components of Planning; a) Zoning b) Roads and road Traffic. a) Housing-Slums, Parks, Play grounds. b) Public Utility Services. c) Surveys and maps for planning. d) Neighbourhood Planning. Planning New town, planning standards, National and regional Planning, town planning and legislation. Garden cities and satellite town

Student Activity: Prepare a detailed report on various ancient Indian architectural elements.

Text Books:

5. Indian Architecture – Vol:- I and II by Percy Brown, Taraporevala Publications, Bombay.
6. Planning and 'Design of Building -Section of Architecture by Y.S.Sane.
7. Town and Country .Planning - A.J.Brown and H.M.Sherrard.
8. Town Design .- Federik Gibbard, Architectural press, London.
9. National Building Code of India.
10. Town Planning in India - Town and Country Planning Organisation, New Delhi 1962.

Reference Books:

7. Modern Architecture and Design by Nikolans, Pevshar.
8. Modern Ideal Hol11nes for India by R.S.Deshpande
9. Regional Planning - Misra R.P., Mysore University.
10. Urban and Regional Planning; Principles and case studies by K.S.Rama Gouda, Mysore University Publications.
11. Town and Country Planning - P. Abercrombe, Oxford University press.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4E3	Water resources systems: Modelling and Analysis	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To analyse water resources systems with different ideas of comprehensive and integrated planning of a water resources project.	2,3,7	2,3
CO2	To know the concept of linear programming and apply in water resource system.	2,3,7	2,3
CO3	Understanding the concept of dynamic programming and apply in water resource system.	2,3,7	2,3
CO4	To understand constrained Linear Programming for reservoir operation and design.	2,3,7	2,3
CO5	To develop skills in solving problems in operations research through LP, DP and Simulation techniques.	2,3,7	2,3
CO6	To understand the concept of optimization for water quality control and reservoir operation.	2,3,7	2,3

MODULE – I

Introduction – Concepts of Systems and Systems Analysis; Systems Techniques in Water Resources : Optimization with methods using calculus;

MODULE – II

Linear Programming - Graphical method - Simplex method - Multiple solutions – Unbounded and infeasible problems - Dual problem.

MODULE – III

- Dynamic Programming - Introduction to Dynamic Programming - Water allocation problem - Reservoir operation problem - Capacity expansion and shortest route problems.

MODULE – IV

Reservoir Systems – Random inflows - Basic probability theory - Chance constrained Linear Programming for reservoir operation and design - Stochastic Dynamic Programming for reservoir operation.

MODULE – V

Simulation: Introduction to Multi-objective planning - Reservoir sizing - Reservoir capacity using Linear Programming - Reservoir operation - Multi-reservoir systems - Stationary policy using Dynamic Programming - Hydropower generation.

MODULE – VI
Fuzzy Optimization - Fuzzy optimization for water quality control and reservoir operation – Conjunctive use of ground and surface water - Hydropower optimization - Crop yield optimization - Multi-basin and multi-reservoir systems.

Student Activity: Prepare a detailed report on various simulation techniques in Water resources systems.

Text Books:

1. Vedula, S. and Mujumdar,P.P.(2005) Water Resources Systems : Modelling Techniques and Analysis, Tata McGraw Hill, New Delhi.
2. Loucks, D.P. and Ellco Van Beek (2005) Water Resources Systems Planning and Management :An Introduction to Methods, Models and Applications., UNESCO, Netherlands.

Reference Books:

1. Mays L.W and Tung Y-K,(1992) Hydrosystems Engineering and Management, McGraw Hill, USA.
2. Simonovic, S.P.(2009) Managing Water Resources : Methods and Tools for a Systems Approach, UNESCO Publishing, France

OPEN ELECTIVE - 01

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4O1	Engineering Geology	2	0	0	2	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know the importance of geology & weathering of rocks.	1, 7	2
CO2	To know various minerals & their usages based on their properties	1, 7	2
CO3	To know the formation of rocks, classification & will be able to identify rocks based on its physical appearances	1, 7	2
CO4	To know about formation of Ground water, Landslides & Earthquakes & their preventive measures	1, 7	2
CO5	To gain knowledge about geophysical conditions, Grouting techniques in Earth & electrical resistance & their importance.	1, 7	2
CO6	To understand the importance of geological considerations for construction of heavy structures like Dams, Reservoirs & Tunnels	1, 7	2

MODULE – I

INTRODUCTION: Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology.

Weathering Of Rocks: Its effect over the properties of rocks importance of weathering with reference to dams, reservoirs and tunnels weathering of common rock like “Granite”

MODULE – II

Mineralogy: Definition of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldspar , Quartiz , Flint , Jasper, Olivine , Augite , Hornblende , Muscovite , Biotite , Asbestos, Chlorite , Kyanite , Garnet, Talc , Calcite. Study of other common economics minerals such as Pyrite, Hematite , Magnetite, Chrorite, Galena , Pyrolusite , Graphite, Magnesite, and Bauxite.

MODULE – III

Petrology: Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Dykes and sills, common structures and textures of Igneous. Sedimentary and Metamorphic rocks. Their distinguishing features, Megascopic study of Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

MODULE – IV
Ground Water, Earth Quake & Land Slides: Ground water, Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration. Earth quakes, their causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Landslides, their causes and effect; measures to be taken to prevent their occurrence. Importance of study of ground water, earth quakes and landslides.
MODULE – V
Geophysical Studies: Importance of Geophysical studies Principles of geophysical study by Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and Geothermal method. Special importance of Electrical resistivity methods, and seismic refraction methods. Improvement of competence of sites by grouting etc.
MODULE – VI
Geology of Dams, Reservoirs and Tunnels: Types of dams and bearing of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factor's Contributing to the success of a reservoir. Geological factors influencing water Lightness and life of reservoirs. Purposes of tunneling, Effects of Tunneling on the ground Role of Geological Considerations (i.e. Tithological, structural and ground water) in tunneling over break and lining in tunnels.

Student Activity: Prepare a report on various rocks and minerals that are available in surrounding localities.

Text Books:

1. Engineering Geology by N.Chennkesavulu, Mc-Millan, India Ltd. 2005
2. Engineerring Geology by Vasudev Kanthi, Universities press, Hyderabad.

Reference Books:

1. Engineerring geology by Prabin singh, Katson Pubilcations
2. Engineering geology by Duggal, TMH Publishers.
3. Engineering Geology by Subinoy Gangopadhyay, Oxford University press.
4. Principals of Engineering Geology by K.V.G.K. Gokhale – B.S publications.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4P1	Transportation Engineering laboratory	0	0	3	3	50	50	100

Cos	Course Outcomes	POs	BTLs
	The student will be able to		
CO1	Perform quality control tests on pavements and pavement materials.	4, 9, 10	4, 5
CO2	Conduct test on Aggregate & bitumen	4, 9, 10	4, 5
CO3	Characterize the pavement materials.	4, 9, 10	4, 5

Part-A (Laboratory Experiments)	
Tests on road aggregates	
1.	Aggregate crushing value test
2.	Los Angeles abrasion test
3.	Aggregate impact value test
4.	Aggregate shape test (flakiness & elongation)
5.	Water absorption & Specific gravity of aggregates
Tests on bitumen	
1.	Penetration Test
2.	Ductility Test
3.	Specific gravity Test
4.	Viscosity Test
Demonstration tests	
1.	Bitumen extraction test
2.	Marshall Stability concepts and tests.
3.	Determination of CBR

Part – B (Student Activity)	
Traffic Studies	
1.	Traffic volume studies
2.	Spot Speed Study
3.	Origin & Destination studies
4.	Speed and delay studies

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4P2	Advanced Concrete Technology Laboratory	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know properties and sizes of aggregates.	4, 9, 10	4, 5
CO2	To know performance of concrete by conducting workability tests.	4, 9, 10	4, 5
CO3	To know strength of concrete by conducting destructive and non-destructive tests.	4, 9, 10	4, 5

Tests on Aggregates	
1.	Sieve Analysis of Fine & Coarse Aggregates
2.	Bulking of sand.
3.	Specific gravity of fine aggregate & Coarse aggregate
Workability tests (Fresh concrete)	
1.	Slump test
2.	Compaction factor test
3.	Vee-bee Test
4.	Flow Table Test
Tests on Hardened concrete: Mix design by IS:10262-2019	
1.	Compression test on concrete cubes
2.	Flexure test on beam
3.	Splitting Tensile strength Test
4.	Accelerated curing Test
Non-destructive tests on concrete	
1.	Rebound hammer
2.	Ultrasonic pulse Velocity (UPV)
Demonstration Tests	
1.	V-Funnel
2.	L-Box
3.	U- Box
4.	Slump Flow
5.	J–Ring

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4K1	Skill/Job Oriented Course-02	0	2	0	2	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To develop various elements of soft and effective communication skills.	9, 10, 12	3, 4

Soft skills and Advanced communication skills

The student must learn **Soft skills and Advanced communication skills (including laboratory)** which can be dealt by course instructor allotted by the department head.

Suggested Input Learnings:

➢ **Soft skills:**

- JAM
- Oral Presentation
- Group Discussion
- Debate
- Role Play

➢ **Advanced Communication Skills Laboratory:**

- Listening Skills
- Note Taking/Note making
- Resume/CVV writing
- PPT slides
- Interview Skills- Mock Interview/ Public speaking

Note:

Marks can be awarded based on internal assessment such as submissions, performance, viva voce etc.
Total marks:100

➢ 50M - Internal: Day to day performance, Record, Viva, Attendance} &

➢ 50M – External: {soft skills- 25M (Write up - 10M, Performance - 15M) , AELCS- 25M (Write up – 10M, Performance – 15M)}

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	CT21B4TS	Technical Seminar	0	2	0	1	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To demonstrate public speaking with the aid of Power Point Presentations.	9,10,12	6
CO2	To identify current general and specific technological topics of interest and prepare and present the content cogently.	9,10,12	6
CO3	To demonstrate communication skills and interview performance skills.	9,10,12	6

Procedure:

1. Seminar in-charges shall highlight the significance of technical seminar in the first two sessions and enlighten the students on the utility of these seminars.
2. The slots, titles shall be decided upfront and seminar in charge shall take signatures.
3. The same sheet shall be affixed in the respective classrooms and seminar register.
4. Progress of the seminars is reviewed by the concerned Departmental Head once in 15 days.
5. The evaluation for technical seminars is informed to students and displayed in the classrooms.
6. The presentation (PPT) must contain topic, introduction, explanation, diagrams, tables, applications and conclusions.

Distribution of marks

There shall be a Technical Paper writing and seminar evaluated for 100 marks The evaluation is purely internal and will be conducted as follows:

Content	: 20 marks
Presentation including PPT	: 20 marks
Seminar Notes	: 10 marks
Interaction	: 10 marks
Report	: 25 marks
Attendance	: 10 marks
Punctuality	: 5 marks
Total	**100 marks**

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
IV	MC21B401	Essence of Indian Traditional Knowledge	2	0	0	0	-	-	-

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Identify the concept of Traditional knowledge and its importance.	6, 8, 12	1, 2
CO2	To Explain the need and importance of protecting traditional knowledge.	6, 8, 12	1, 2
CO3	To Illustrate the various enactments related to the protection of traditional knowledge.	6, 8, 12	1, 2
CO4	To Interpret the concepts of Intellectual property to protect the traditional knowledge.	6, 8, 12	1, 2
CO5	To Explain the importance of Traditional knowledge in Agriculture and Medicine.	6, 8, 12	1, 2
CO6	To understand the importance of Indian ancient education system and benefits.	6, 8, 12	1, 2

MODULE - I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge.

MODULE - II

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

MODULE - III

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

MODULE - IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge.

MODULE - V

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity,

Food security of the country and protection of TK.
MODULE - VI
Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

Text books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Narain, "Examinations in ancient India", Arya Book Depot, 1993
3. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
4. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978-8120810990, 2014

Reference Books:

1. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
4. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
5. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200

SEMESTER V

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5C1	Design of Reinforced Concrete Structures	3	2	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To familiarize with design philosophies and principles of RCC.	1, 3, 4	3, 4, 5
CO2	To design and solve problems in context to flanged, singly & doubly reinforced beams.	1, 3, 4	3, 4, 5
CO3	To understand the behaviour of RC elements subjected to shear, Torsion & bond.	1, 3, 4	3, 4, 5
CO4	To demonstrate the procedural Knowledge in design of RCC slabs according to IS codal Provisions	1, 3, 4	3, 4, 5
CO5	To understand the behaviour of columns subjected to uniaxial & biaxial bending and Limit state design of serviceability.	1, 3, 4	3, 4, 5
CO6	To Design reinforced concrete footings & staircase according to site conditions.	1, 3, 4	3, 4, 5

MODULE – I

Introduction: Materials used in RCC, type of loads on Structure as per (IS:875), Need for Reinforcement in Concrete – Basic requirements of an RCC Structure (stability, strength, serviceability and durability). Introduction to Working stress method and design constants, ultimate load design.

Fundamentals of limit state design method: Concept of limit state design philosophy, principle of limit state, Advantages of Limit State Method over other methods, Design loads, characteristic load, design strength, characteristic strength, Partial safety factors, Assumptions in the limit state method of design in flexure, Stress – Strain Curves for Concrete and Steel, stress block parameters, limiting moment of resistance, IS codal provisions.

MODULE – II

Design of beams by LSM: Analysis and design of singly and doubly reinforced rectangular beams, Flanged beams (T & L beams) by Limit State Method.

MODULE – III

Limit State of collapse in Shear, Torsion & Bond: Behaviour of rectangular RC beams in shear and torsion codal provisions – Design examples in simply supported, cantilever and continuous beams, including detailing. Concept of bond, bond stress, factors affecting development of bond stress, types of bond, anchorage and development length, I.S. code provisions and numerical problems.

MODULE – IV

Design of slabs: General notes on IS codal provisions, Design of one-way slab - Two-way slab, cantilever slab, continuous slab as per IS-456 codal provisions.

MODULE – V
Design of columns: Short and Long columns –axial loads, uni axial and biaxial bending IS Code provisions. **Serviceability:** Limit state design of serviceability for deflection, cracking and codal provision.
MODULE – VI
Design of Footings: Different types of shallow footings, soil pressure distribution below the footings, IS codal provisions. Design of Square footing, Rectangular footing and Combined Rectangular footing for two columns only. **Staircase:** Components of staircase, Types of stairs, Design of Dog-legged staircase and open well staircase.

Note: All Designs must be carried out as per Limit State Method.

EXTERNAL EXAMINATION PATTERN: The end examination paper should consist of Part A and Part B. Part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions on design out of which three are to be answered.

Weightage for Part – A is 40% and Part- B is 60%.

Student Activity: Design of various structural elements in multistoried buildings and provide detailed drawings with specifications.

Text Books:

1. Reinforced concrete design by N. Krishna Raju and R.N. Pranesh, New age International Publishers, New Delhi.
2. Subramanian.N," Design of Reinforced Concrete Structures", Oxford University Press, New Delhi,
3. Limit State Design by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

Reference Books:

1. Reinforced concrete design by S.Unnikrishna Pillai &Devdas Menon, Tata Mc. Graw Hill, New Delhi.
2. Varghese P.C, "Limit State Design of Reinforced Concrete", Prentice Hall of India,
3. IS:456-2000, Code of Practice for Plain and Reinforced concrete, Bureau of Indian Standards, New Delhi, India.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5C2	Estimation & Quantity Surveying	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the fundamentals, units of estimation and General items of work in Building.	1, 2	2, 3
CO2	To understand and prepare detailed estimate of quantities and costs for R.C.C structures.	3, 4	3, 4
CO3	To understand the general specifications of civil works using various techniques and concepts related to Tendering procedure.	3, 4	3, 4
CO4	To prepare detailed Earthwork estimates for Roads & Canals using various techniques.	3, 4	3, 4
CO5	To learn the BOQ concepts, estimate the steel quantities and preparation of bar bending schedule.	3, 4	3, 4
CO6	To prepare detailed specifications and provide exposure to rate analysis for different items of work.	2, 3	3, 4

MODULE – I

Introduction: Introduction to quantity surveying and its importance. Duties of quantity surveyor, General items of work in Building – Standard Units –Types of Estimates- Principles of working out quantities for detailed and abstract estimates, Approximate method.

MODULE – II

Detailed estimates of buildings: Methods of taking out quantities and preparation of detailed and abstract estimates of one/two bed room building by using center line method and long walls & short walls.

MODULE – III

General specifications of civil works: Purpose of specifications**,** Specification of Earthwork in Excavation, Brick masonary, Damp proof coarse, masonry work in super structure, R.C.C. Work in lintel/chajja/sunshade, RCC work in roof, plastering, whitewashing, distempering, wood work for windows and doors, brick walls, flooring, Plastering Work, Painting, Flooring.

Tenders: Requirement of Tendering, Tender notices - types - tender procedures Drafting model Tenders.

MODULE – IV

Earthwork Estimation: Quantities of earthwork in embankment and Cutting using Mid sectional rule, Trapezoidal rule, Prismoidal rule. Detailed estimate of WBM roads, CC roads and bituminous roads, rectangular box culvert, Septic tank.

MODULE – V

Estimation of steel quantities, BOQ preparations & Bar Bending Schedule: Estimation of steel quantities and preparation of bar bending schedule (BBS) for RCC works like Footings, Beams, Columns

and slab and Stair case.
MODULE – VI
Analysis of rates & Lead: BOQ, purpose of rate analysis and SSR. Rate Analysis for earthwork, concrete work (R.C.C. slabs, columns and beams, footings), Quantity estimation for Brick work, flooring, Floor tiles Skirting, Wall Tiles and false ceiling along with mortar. Quantity estimation of Timber for Doors and Windows, Wall Putty, Primer Paint, Emulsion and Enamel Paint Calculations. Preparation of Lead statements.

Student Activity: Preparation of Detailed Project Report of a case study project with Rate Analysis.

Shuttering areas and concrete volume calculations, M-BOOK recording

Finding area of Shuttering and concrete volume calculations for footing, Column, slabs, beams etc. and different shapes.

Measurement books and its importance – procedure of recording and checking measurements – preparation of bills.

Text Books:

1. B.N.Dutta, Estimating and Costing in Civil Engineering, 28th Revised Edition, UBS Publisers, 2016.
2. G.S.Birdie, Estimating and Costing (Civil Engineering), 6 th Edition, DhanpatRai Publishing Company, 2014.

Reference Books:

1. Standard Schedule of Rates and Standard data book, Public works Department.
2. M. Chakraborti, Estimating, Costing, Specification & Valuation in Civil Engineering, 24th Edition, 2010.
3. A.K. Upadhyay, “Civil Estimating and Costing”, 10th Edition, S.K. Kataria and Sons Publishers, 2013.
4. A.Bhasin P.L., "Quantity Surveying", 2nd Edition, S.Chand& Co., 2000

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5C3	Quality and Safety Management in Construction	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the quality management and its need in industrial field.	6, 11	2, 3
CO2	To gain knowledge on TQM models and their benefits.	6, 11	2, 3
CO3	To understand the standards of quality management systems and safety designing in construction projects	6, 11	2, 3
CO4	To understand different safety management strategies for construction sites.	6, 11	2, 3
CO5	To know various types & causes of accidents in Construction Industry and their prevention.	6, 11	2, 3
CO6	To know about fire prevention control and various common hazards in construction industry.	6, 11	2, 3

MODULE – I

Quality: Principles, Concepts in Quality Management, Managing for quality, Impact of Quality Management in Business and Commerce. Quality Control, Quality costs and its components, Features of Quality, Determinants of service Quality, Need for Quality management in industry.

MODULE – II

Total Quality Management: Meaning and Scope, TQM models – Oakland Model, integrated model of TQM, Building blocks of TQM, 3-D Model of TQM, Benefits of TQM program, causes for TQM failures, Remedial measures, Quality Manuals, System Procedures. ISO 14000: Environmental Management – general requirements, Environmental Policy, Planning, Implementation and operation, Checking and Corrective action.

MODULE – III

Quality Management System in Construction Projects: Concept, Approach to Problems, Quality Assurance, Quality Control, Quality Inspection, Records and Reports, Training, Total Quality Control, Manual/Check Lists, Guide Lines.

Designing For Safety: Safety clause in a typical contract document, Scheme for safety, Breach of safety regulations, General safety condition, Safety culture, Company activities and safety, Project co-ordination and safety procedures, Workers compensation.

MODULE – IV

Safety Management: Introduction**,** salient features of safety programs, general safety programs for construction. Safe working environment, Safety clauses in contract documents, Safety programme, Safety policy, Safety department, safety officers, safety records, safety training. Safety lacunae in Indian Construction Industry- Safety Standards - Indian standards for safety in construction.

MODULE – V

Construction Accidents And Safety: Accident- Causes, Effects and Safety measures, Legal

requirements, Responsibility of the employers. Reporting occurrence of accidents, Reporting occurrence of hazards, Action to be taken by the Site-in-charge in case of accidents.
MODULE – VI
Fire Prevention and Control: Understanding fire chemistry, Behaviour of fuels in fire, Fire causes, Types of extinguisher sand use, Fire prevention planning, Check list for fire prevention. Emergency Escape-Means of Escape, Evacuation, Occupant fire fighting. **Common Hazards:** Dust, Impregnated timber, Lead poisoning, Toxic fumes, Noise, Code of practice for reducing noise, Vibration, Power supply, Lighting, Maintenance, House-keeping, Materials, Movement, Drowning, Openings, Weight.

Student Activity: Quality audit using checklist for various Engineering Structures and also a report on safety audit of a sample project with suitable checklist

Text books:

1. Total Quality Management for Engineers by Mohammed Zairi, Aditya Books Pvt. Ltd., New Delhi. 1992.
2. Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
3. Total Quality Management by B. Janakiraman and R.K. Goapal, Prentice-Hall of India Private Limited, New Delhi.
4. Construction Safety Management, NICMAR Publications, Hyderabad
5. Jimmy W. Hinze, construction safety, Prentice hall Inc 1997

Reference Books:

1. Quality in the Construction Project by Fox, Arthur J., and Holly A. Cornell, American Society of Civil Engineers, New York, Latest Edition.
2. Total Quality Management by Mohantry R.P. and Lakhe R.R., Jaico Publishing House, Mumbai, 2000.
3. Total Quality Management by Break Joseph and Susan Joseph, Excel Books, New Delhi, 1995.
4. Total Quality in Construction Projects by Hellard R.B.: Achieving profitability with customer satisfaction, Thomas Telford, London, 1993.
5. Quality Management by Manjual, Satish, Raj Publishing House, Jaipur, 1999
6. Richard.J.Coble, Jimmoe and TheoeHampt, Construction Safety and Health Management, Prentice Hall Inc 2001.
7. Aswathappa A., (2000) "Organizational Behaviour: Texts and cases Himalaya Publishing House, Mumbai.
8. Hersey Paul, Kenneth Blanchard H., "Management of Organizational Behaviour: Utilising Human Resources", Prentice Hall India Ltd. Edition, New Delhi.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5C4	Geotechnical Engineering	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the classification of soil, index properties of soils and their relation to the formation of soils.	2, 4, 7	2, 3
CO2	To illustrate the engineering properties, effects of permeability on soil behaviour and to know about the seepage in soils by using flow nets.	2, 4, 7	2, 3
CO3	To know the stress distribution in layered in soils and also effects of compaction on soils.	2, 4, 7	3, 4
CO4	To understand the primary and secondary settlements in the soils with respect to time.	2, 4, 7	2, 3
CO5	To understand the shear strength of soils and also to know the various methods involved in soil exploration.	2, 4, 7	3, 4
CO6	To understand the settlement of shallow and pile foundations.	2, 4, 7	3, 4

MODULE – I

Introduction: Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their interrelationships. Soil Structure.

Index Properties: Determination of Index Properties -Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis) Atterberg's Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.

MODULE – II

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

Seepage Through Soils: Total, neutral and effective stresses –quick sand condition – Seepage through soils – Flow nets: Characteristics and Uses.

MODULE – III

Stress Distribution in Soils: Boussinesq"s and Westergaard"s theories for point loads and areas of different shapes – Newmark's influence chart.

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties. – Field compaction Equipment – compaction control.

MODULE – IV

Soil Consolidation: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay – Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods. Types & Stability Of Retaining walls.

MODULE – V

Shear Strength of Soils: Importance of shear strength – Mohr's– Coulomb Failure theories – Types of

laboratory tests for strength parameters – strength tests based on drainage conditions – Shear strength of sands - dilatancy – Liquefaction- shear strength of clays. **Soil Exploration:** Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Plate load test – Pressure meter.
MODULE – VI
Shallow Foundations: Types of foundations & its applications– Location of depth – Safe Bearing Capacity – Terzaghi`s, Meyerhof's & Skempton`s Methods (Derivations & basic problems) **Pile Foundation:** Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Load carrying capacity of pile groups in sands and clays.

Student Activity: Analysis of structural behaviour of soils from surrounding locations

Text Books

1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Geotechnical Engineering by C. Venkataramiah, New age International Pvt . Ltd, (2002).
3. Soil Mechanics and Foundation by byB.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi.

Reference Books:

1. Geotechnical Engineering by Iqbal H.Khan, PHI pubilishers.
2. Basic and Applied Soil Mechanics by Gopal Ranjan& ASR Rao, New age International Pvt . Ltd, New Delhi.
3. Alam Singh and Chowdhary G.R. (1994), "Soil Engineering in Theory and Practice", CBS Publishers and Distributors Ltd., New Delhi.
4. Bowles, J.E. (1996), "Foundation Analysis and Designs", 5th Edition, McGraw Hill Publishing Co., New York.
5. Murthy, V.N.S. (1996), "Soil Mechanics and Foundation Engineering", 4th Edition, UBS Publishers and Distributors, New Delhi.
6. Gopal Ranjan and Rao, A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.

PROFESSIONAL ELECTIVE - 02

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5E1	High Rise Buildings	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the design Criteria for Structural Design of Tall Buildings.	1, 5, 11	1, 2
CO2	To understand various concepts related to building management	1, 5, 11	1, 2
CO3	To understand the concepts involved in Site Investigation.	1, 5, 11	1, 2
CO4	To understand various equipment involved in material handling	1, 5, 11	1, 2
CO5	To understand the behavior of tall buildings under Wind and Seismic loads along with various design concepts mentioned in standard codes	1, 5, 11	1, 2
CO6	To learn the importance of various structural forms in high rise architecture.	1, 5, 11	1, 2

MODULE – I

Evolution of Tall Buildings: Introduction, Design Criteria for Structural Design of Tall Building, Concept of Premium for Height, Development of High-Rise Architecture.

MODULE – II

Assembly of Building: Building Performance –Cost, Quality and Time, Environmental Requirements, Industrialization& Robotics in Construction, Introduction to Safety and Health Management System.

MODULE – III

Site Investigation: Stages of Site Investigation, Site Reconnaissance & Ground Investigation-Field Tests & Laboratory Tests.

MODULE – IV

Foundation Systems: Foundation Systems, Material Handling and Mechanization: Material Handling Considerations, Earthmoving Equipment's, Horizontal and Vertical Movements, Selection & Utility of Cranes (Tower Cranes & Climbing Cranes).

MODULE – V

Wind Effects on Behaviour of Tall Structures: Outlook of Design Considerations and Characteristics Of Wind, codal Wind Loads And Cladding Pressures On Behavior Of Tall Buildings.

Seismic Effects on Behaviour of Tall Structures: Introduction To Tall Building Behavior During Earthquakes And Seismic Design Philosophy – Building Behaviour – Seismic Design Concept – Dynamic Response Concept – Dynamic Analysis Theory – Design Techniques.

MODULE – VI

Structural Forms & Flooring Systems: Introduction of Various Structural Forms and Their Importance to High Rise Architecture, Introduction to Various Flooring Systems In Concrete & Steel.

Students Activity: Case study on failures and challenges of high rise buildings.

Text Books:

1. Concrete And Composite Design Of Tall Buildings. By Taranath, B, Steel, 2nd Edition, Mcgraw Hill, 1998.
2. Tall Buildings Structures Analysis And Design By Bryan S,Smith And Alex Coull, Wiley India Pvt Ltd.
3. The Design Of Building Structures.By Wolfgang Schueller, , Prentice Hall India,

Reference Books:

1. Reinforced Concrete Design Of Tall Buildings By S.Taranath.B, CRC Press.
2. Building Structural Design Handbook .By White And Salmon, John Wiley & Sons.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5E2	Low-cost Construction Techniques	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To identify the status of Land use and Planning for Housing.	5, 6, 7	1, 2
CO2	To identify the low-cost construction techniques by using different materials.	5, 6, 7	1, 2
CO3	To identify the low-cost infrastructure services and to know the traditional practices.	5, 6, 7	1, 2
CO4	To identify the Construction requirements of Structural Safety of Thin Precast Roofing Units Against Earthquake Forces.	5, 6, 7	1, 2
CO5	To know the low cost infrastructure services, and rural housing methods.	5, 6, 7	1, 2
CO6	To identify the housing in disaster prone areas and to implement the social housing programs.	5, 6, 7	1, 2

MODULE – I

Housing Scenario and Finance: Introduction - Status of Urban Housing - Status of Rural Housing Introduction to housing finance - Existing Finance System in India - Government Role as Facilitator - Status at Rural Housing Finance - Impedimently In Housing Finance and Related Issues.

MODULE – II

Land Use And Physical Planning For Housing: Planning of urban land- Urban land ceiling and regulation act - Efficiency of building bye laws - Residential Densities - Housing the Urban Poor: Living conditions in slums- Approaches and strategies for housing urban poor.

MODULE – III

Development And Adoption Of Low Cost Housing Technology: Introduction - Adoption Of Innovative Cost Effective Construction Techniques - Adoption of Precast Elements In Partial Prefabrication - Adopting Of Total Prefabrication Of Mass Housing In India - General Remarks On Pre Cast Rooting/Flooring Systems -Economical Wall System - Single Brick Thick Loading Bearing Wall - 19cm Thick Load Bearing Masonry Walls - Half Brick Thick Load Bearing Wall - Fly ash Gypsum Thick For Masonry - Stone Block Masonry - Adoption Of Precast R.C. Plank And Join System For Roof/Floor In The Building.

MODULE – IV

Alternative Building Materials for Low Cost Housing: Introduction - Substitute for Scarce Materials – Ferro cement - Gypsum Boards – Timber Substitutions - Industrial Wastes - Agricultural Wastes – Future strategies for promotion of Alternative Building Materials.

MODULE – V

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

Rural Housing: Introduction - Traditional Practice of Rural Housing Construction –Appropriate Rural Housing technology - Mud Housing Technology - Mud Roofs - Characteristics of Mud – Fire Retardent Treatment For Thatch Roof – Soil Stabilization - Rural Housing Programs.
MODULE – VI
Housing In Disaster Prone Areas: Introduction – Earthquake - Damages To Houses – Traditional Housing in disaster Prone Areas – Type Of Damages And Failures Of Non-Engineered Buildings - Repair And Restoration Of Earthquake Damaged Non-Engineered Buildings - Recommendations For Future Constructions - Requirements of Structural Safety of Thin Precast Roofing Units Against Earthquake Forces -status Of R& D In Earthquake Strengthening Measures - Floods, Cyclone, Future Safety. **Social Housing Programmes:** Introduction, Implementing Agencies for Social Housing Programmes, Performance of Social Housing Schemes, Typical Specifications for Low Cost Housing: Urban.

Student Activity: Case study and comparison of low-cost building with similar traditional building

Text books:

1. Building materials for low –income houses – International council for building research studies and documentation.
2. Hand book of low cost housing - by A. K. Lal – Newage international publishers.

Reference books:

1. Light weight concrete- Academic Kiado- Rudhai. G – Publishing home of Hungarian Academy of Sciences 1963.
2. Modern trends in housing in developing countries – A.G. Madhava Rao- D.S. Ramachandra Murthy & G. Annamalai
3. Low-Cost Housing – G.C. Mathur.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5E3	Ground Improvement Techniques	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To learn the fundamental concepts of ground improvement techniques	5, 7	1, 2
CO2	To understand the concepts of mechanical modification, Hydraulic Modification	5, 7	1, 2
CO3	To understand the importance of Chemical modification and thermal modification in improving the properties of soil.	5, 7	1, 2
CO4	To know the soil stabilization using different types of reinforcements	5, 7	1, 2
CO5	To understand the applications of soil reinforcement in different types of structures	5, 7	1, 2
CO6	To learn different types of grouting for soils and miscellaneous methods that are used as ground improvement techniques	5, 7	1, 2

MODULE – I

Ground Improvement: Role of ground improvement in foundation engineering-methods of ground improvement, situations where ground improvement is necessary-Geotechnical problems in alluvial, lateritic and black cotton soils.

MODULE – II

Mechanical Modification: Dynamic compaction, Impact loading, Compaction by blasting, Vibro-Compaction: Pre-Compression, Stone columns, Hydraulic modifications, Dewatering systems, Preloading and vertical drains, Electro- Kinetic Dewatering

MODULE – III

Chemical Modification: Modification by Admixtures, Stabilization using industrial wastes.
Thermal Modification: Ground Freezing and thawing.

MODULE – IV

Soil Reinforcement: Reinforced earth, Basic Mechanism, Type of Reinforcements, Selection of Stabilization/ Improvement of ground using geo-textiles, geo-grids, geo-membranes, Geo-cells, Geo-nets and soil nailing.

MODULE – V

Application of Soil Reinforcement: Shallow foundation s on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankment structures, Wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road design with geosynthetics

MODULE – VI

Grouting: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

Student Activity: A report on need of ground improvement in various locally available soils.

Text Books:

1. Ground Improvement Techniques- Purushothama Raj P. (1999) Laxmi Publications, New Delhi.
2. Construction and Geotechnical Method in Foundation Engineering- Koerner R.M. (1985) - Mc GrawHill Pub. Co., New York.
3. Engineering principles of ground modification- Manfred Hausmann (1990) - Mc Graw Hill Pub. Co., New York.

Reference Books:

1. Methods of treatment of unstable ground- Bell, F.G. (1975) Butterworths, London.
2. Expansive soils- Nelson J.D. and Miller D.J. (1992) -, John Wiley and Sons.
3. Soil Stabilization; Principles and Practice- Ingles. C.G. and Metcalf J.B. (1972) - Butterworths,London.
4. Moseley M.P. (1993) Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA.
5. Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994) Ground Control and Improvement, John Wiley and Sons, New York, USA.
6. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall New Jercy, USA
7. Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd.

OPEN ELECTIVE - 02

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5O1	Water Harvesting And Conservation	2	0	0	2	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand various concepts related to Water harvesting methods and principles.	2, 3, 7	2, 3
CO2	To know different Water recovery and reuse methods.	2, 3, 7	2, 3
CO3	To gain knowledge on Sustainable watershed approaches.	2, 3, 7	2, 3
CO4	To gain specific knowledge on issues of watershed management.	2, 3, 7	2, 3
CO5	To understand Watershed modeling techniques	2, 3, 7	2, 3
CO6	To gain knowledge on methods of soil and water conservation.	2, 3, 7	2, 3

MODULE – I

Water Harvesting: Principles of water harvesting-methods of rainwater harvesting-design of rainwater harvesting structures-Purification Techniques for direct use- Harvesting of surface runoff-onsite detention basin - ponds - types - Recycling of harvested water.

MODULE – II

Water Recovery and Reuse: Perspective on recycle and reuse- factors affecting the development of water reclamation and reuse criteria- elements/components of water reclamation and reuse criteria / guidelines-sewage irrigation- Waste water reclamation-waste water recharge for reuse – Treatment Requirements for Water Reuse-methods.

MODULE – III

Sustainable Watershed Approach: Concept of watershed-Introduction to watershed management-Integrated water resources management - natural resources management-agricultural practices. Integrated farming.

MODULE – IV

Watershed Management Practices: Conjunctive use of water resources-Community participation-Watershed Management Practices in Arid and Semiarid Regions-Case studies-Short term and long term strategic planning.

MODULE – V

Watershed Modeling: Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall- runoff process,

subsurface flows and groundwater flow.
MODULE – VI
Soil and Water Conservation: Scope of soil and water conservation-Mechanics and types of erosion-their causes-Soil erosion control measures - bank protection-vegetative barriers - contour bund- contour trenches-contour stone walls-contour ditches-terraces-outlets and grassed waterways-Gully control structures - temporary and permanent - design of permanent soil conservation structures-Design of farm ponds and percolation ponds.

Student Activity: Prepare a report on various farming and agriculture practices in India.

Text Books:

1. Pierce, F.J. and Frye, W. W. (1998): Advances in Soil and Water Conservation, Ann Arbor Press, Michigan.
2. Schwab, G. O., Fangmeier, D. D., Elliot, W. J. and Frevert, R. K. (1993): Soil and Water Conservation Engineering, 4th Ed. John Wiley and Sons Inc., USA.
3. Murty, J.V.S. "Watershed Management", New Age Intl., New Delhi 1998.
4. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 .

Reference Books:

1. Dilip Kumar Majumdar, Irrigation water management - Principles and Practice, PHI Pvt.Ltd.NewDelhi-1.
2. Madan Mohan Das&Mimi Das Saikia, Irrigation and water power Engineering,PHI learning pvt. Ltd., NewDelhi-1
3. Chatterjee, S. N., Water Resources Conservation and Management, Atlantic Publishers, 2008

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5P1	Geotechnical Engineering Laboratory	0	0	3	3	50	50	100

Cos	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To test the basic index properties of soil.	4, 9, 10	4, 5
CO2	To test the various engineering properties of soil.	4, 9, 10	4, 5

1. Tests for determination of specific gravity and moisture content
2. Grain Size analysis of soil samples (Sieve analysis)
3. In situ density by core cutter and sand replacement methods
4. Consistency limits
5. Free Swell Index
6. California Bearing Ratio Test
7. Standard proctor compaction test and modified proctor compaction test
8. Coefficient of permeability by constant head and variable head methods
9. Unconfined compression test
10. Direct shear test
11. Triaxial compression test (Undrained)
12. Consolidation test – Determination of compression index and coefficient of consolidation

Relevant BIS Codes of Practice: 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) –1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) –1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) –1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983;IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1966, IS 2720 (Part-60) 1965.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5S1	Quantity Estimation and Construction Practices Studio	0	0	3	3	50	50	100

Cos	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To estimate quantities of various building materials required.	4, 9, 11	4, 5
CO2	To prepare DPR for a project.	4, 9, 11	4, 5

Part – A
1. BOQ preparation.
2. Bar bending: a) Straightening, bending, hooking demo for slab, beam and stirrups and column construction, Lapping. b) Bar bending Schedule preparation (Slab, Beam& Lintel etc.)
3. Estimation of concrete volume quantities of footings, columns, beams, slabs etc. for a structure or building
Part – B
4. Construction of Flemish & English bond and stone masonry and brick masonry construction work.
5. Plastering: Mixing Technique of applying plaster using trowel, float etc., Plastering vertical surface to plumb (field visit suggested) and calculation of cement mortar quantities for plastering.
6. Preparation of DPR for G+1 buildings.
7. Preparation of DPR for G+1 buildings & CC Roads.
8. M-Book recording of quantities & Miscellaneous.
9. Visit to construction site for painting.
10. Model making of water tanks, bridges, dams, Arches etc. with locally available eco-friendly materials.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
V	CT21B5K1	Skill/Job Oriented Course-03	0	2	0	2	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To acquire knowledge on programming skills by using python.	5	2, 3

Python Programming

The student must learn **Python Programming** software course as per the guidelines prescribed by the concerned department.

Suggested Input Learnings:

1. Introduction Python
2. Data structures loops variables literals
3. Structure of python language
4. Objects classes constructors files
5. Oops concepts

Note:

1. The Departmental head will instruct the students, whether the course is to be done either in offline or online mode, at the starting of the semester.
2. If the course is to be done in online mode, the generated certificate after successful completion of course should be produced in the concerned department. The marks will be awarded on the basis of certificate produced and Viva voce.
3. If the course is to be done in offline mode, then the course instructor allotted by the department head should award marks based on internal assessment such as submissions, performance, viva voce etc.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
V	GN21B5CSP	Community Service Project	(During Vacation) 180 hours			4	100	–	100

COs	Course Outcomes	POs	BTLs
	The student will be able to		
CO1	Involve in community development and service activities and applies the experience to personal and academic development.	2, 9, 10	2, 3

Introduction:

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective:

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships.

The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability.
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project:

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern.
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.

- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

Agriculture	Law & Order
♣ Health	♣ Excise and Prohibition
♣ Marketing and Cooperation	♣ Mines and Geology
♣ Animal Husbandry	♣ Energy
♣ Horticulture	♣ Internet
♣ Fisheries	♣ Free Electricity
♣ Sericulture	♣ Drinking Water
♣ Revenue and Survey	♣ Irrigation
♣ Natural Disaster Management	

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity.

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding.
- Improved social responsibility and citizenship skills.

- Greater involvement in community service after graduation.

Career Development

- Connections with professionals and community members for learning and career opportunities.
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

- Stronger relationships with faculty.
- Greater satisfaction with college.
- Improved graduation rates.

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning.
- New avenues for research and publication via new relationships between faculty and community.
- Providing networking opportunities with engaged faculty in other disciplines or institutions.
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment.
- Improved student retention.
- Enhanced community relations.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation.
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability	21. Plant diseases
2. Health and hygiene	22. Yoga awareness and practice
3. Stress levels and coping mechanisms	23. Health care awareness programmes and their impact
4. Health intervention programmes	24. Use of chemicals on fruits and vegetables
5. Horticulture	25. Organic farming
6. Herbal plants	26. Crop rotation
7. Botanical survey	27. Floury culture
8. Zoological survey	28. Access to safe drinking water
9. Marine products	29. Geographical survey
10. Aqua culture	30. Geological survey
11. Inland fisheries	31. Sericulture
12. Animals and species	32. Study of species

13. Nutrition	33. Food adulteration
14. Traditional health care methods	34. Incidence of Diabetes and other chronic diseases
15. Food habits	35. Human genetics
16. Air pollution	36. Blood groups and blood levels
17. Water pollution	37. Internet Usage in Villages
18. Plantation	38. Android Phone usage by different people
19. Soil protection	39. Utilisation of free electricity to farmers and related issues
20. Renewable energy	40. Gender ration in schooling level- observation.

Complementing the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are:

Programmes for School Children
1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment
1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps
1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days.

Programmes for Youth Empowerment
1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes
1. Awareness on RTI

2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

TIMELINE FOR THE COMMUNITY SERVICE PROJECT ACTIVITY

Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.
- Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

SEMESTER VI

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6C1	Construction Material and Equipment Management	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know the significance of construction equipments used for construction activities.	2, 5, 11	2, 3
CO2	To understand the significance of construction equipment used for Earthwork and their operations.	2, 5, 11	2, 3
CO3	To Use the suitable type of construction equipment for executing construction works.	2, 5, 11	2, 3
CO4	To gain knowledge on various equipments for Compaction and pumping.	2, 5, 11	2, 3
CO5	To estimate the material requirement of the project and to know the functions of material management.	2, 4, 11	2, 3
CO6	To gain knowledge on procurement identification of sources and understand the store accounting.	2, 5, 11	2, 3

MODULE – I

Construction Equipment & Management: Identification, construction economy, construction planning, importance of planning, lack of planning, types of planning, equipment management in projects, classification of Equipment, selection of construction equipment, cost of owning and operating, economic life of equipment, cost control of equipment, depreciation analysis.

MODULE – II

Equipment for Earthwork: Fundamentals of Earth Work Operations, Machines for preliminary work, types of Earth Work Equipment - Tractors – applications, Scrapers – types and applications. Motor Graders – applications, safety Power Shovel – types, selection of type and applications. Dragline–types and applications. Clamshells- Classification. Hoe –basic parts, application. Bulldozer –Classification, selection of type of bulldozers.

MODULE – III

Other Construction Equipment: Equipment for Dredging-Classification and applications, Trenching – types, selecting suitable equipment and trench safety. Tunnelling -aspects for construction of tunnels. Drilling–types of drills, factors affecting selection of drilling equipments. Blasting–general terms, explosives (type of explosives), blasting operation, Transporting, handling and storing of explosives. Trucks and Hauling Equipment, Finishing Equipment - Productivity, Trimmers.

MODULE – IV

Equipment for Compaction: Introduction, specification and types of compacting equipments. Foundation

grouting – purpose, exploring the need of grouting, rate of grouting, materials used for grouting, equipments of cement grouting and effectiveness of grouting. Dewatering –types, Pumping Equipments –factors in selecting construction pump and classification.
MODULE – V
Integrated Materials Management: Importance scope objectives and functions of material management, integrated approach to material management. Estimating of materials requirement, phasing of their procurement. Material classification, codification, ABC Analysis, standardization, substitution, variety reduction.
MODULE – VI
Material Procurement: identification of sources, vendor analysis, purchase procedure, legal aspects of purchasing, transporting of materials, mode of transportation. Store management: Store organization, store layout, receipts and inspection, issue of materials care and safety in handling store records and store accounting.

Student Activity: Comparative report on productivities of various construction equipment.

Text Books:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction. Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 1995.
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988

Reference Books:

1. B. Satyanarayana and S.C. Saxena, Constructin, Planning and Equipements, Standard Publishers New Delhi. 1985.
2. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
3. Dr. Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi, 1983

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6C2	Green Building Technologies	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Define, Describe and Explain about the features and benefits of the green building,	5, 7, 11	2
CO2	To understand various Local Building Regulations, Amenities, Guidelines for Site selection and planning of green buildings.	5, 7, 11	2
CO3	To acquire knowledge on various water conservation techniques such as Rainwater Harvesting, Waste Water Treatment, Water Metering etc.	5, 7, 11	2
CO4	To describe and explain the energy efficiency terms and methods used in green building practices.	5, 7, 11	2
CO5	To understand various concepts related to Sustainable Building Materials and Waste material Management and Handling.	5, 7, 11	2
CO6	To gain the knowledge on various methods used to maintain indoor environmental quality and Innovation in Design Process.	5, 7, 11	2

MODULE – I

Green Buildings: Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings- Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage.

MODULE – II

Site selection and planning: Local Building Regulations, Soil Erosion Control, Basic Amenities, Proximity to Public Transport, Low-emitting Vehicles, Natural Topography or Vegetation, Preservation or Transplantation of Trees, Heat Island Reduction, Non-roof, Heat Island Reduction, Roof, Outdoor Light Pollution Reduction, Universal Design, Basic Facilities for Construction Workforce, Green Building Guidelines,

MODULE – III

Water conservation: Rainwater Harvesting, Roof & Non-roof, Water Efficient Plumbing Fixtures, Landscape Design, Management of Irrigation Systems, Rainwater Harvesting, Roof & Non-roof, Water Efficient Plumbing Fixtures, Waste Water Treatment and Reuse, Water Metering.

MODULE – IV

Energy Efficiency: Ozone Depleting Substances, Minimum Energy Efficiency, Commissioning Plan for Building, Equipment & Systems, Eco-friendly Refrigerants, Enhanced Energy Efficiency, On-site Renewable Energy, Off-site Renewable Energy, Commissioning, Post-installation of Equipment & Systems, Energy Metering and Management.

MODULE – V

Building materials: Segregation of Waste, Post-occupancy, Sustainable Building Materials, Organic Waste Management, Post-occupancy, Handling of Waste Materials, During Construction, Use of Certified Green

Building Materials, Products & Equipment.
MODULE – VI
Indoor Environmental Quality: Minimum Fresh Air Ventilation, Tobacco Smoke Control, CO_2 Monitoring, Daylighting, Outdoor Views, Minimize Indoor and Outdoor Pollutants, Low-emitting Materials, Occupant Well-being Facilities, Indoor Air Quality Testing After Construction and Before Occupancy, Indoor Air Quality Management During Construction. **Innovation and Development:** Innovation in Design Process, Optimisation in Structural Design, Water Use Reduction for Construction

Student Activity: Green rating of a building using various rating systems and suggestions on improvement

Text books:

1. Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
2. 'Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.
3. Shahane, V. S, "Planning and Designing Building", Poona, Allies Book Stall, 2004.
4. Michael Bauer, Peter Mösle and Michael Schwarz "Green Building – Guidebook for Sustainable Architecture" Springer, 2010.
5. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison "Green Building Handbook" Volume I, SponPress, 2001.
6. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.

Reference books:

1. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
2. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
3. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
4. Charles J. Kibert, Sustainable Construction - Green Building Design and Delivery, John Wiley &
5. Sons, New York, 2008.
6. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.
7. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6C3	**Prestressed and prefabricated structures**	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the principles of prestressed concrete and various methods of Prestressing.	5, 7, 11	2,3
CO2	To evaluate the losses in prestressed concrete construction	5, 7, 11	2,3
CO3	To propose a suitable cable profile for prestressed concrete member.	5, 7, 11	2,3
CO4	To understand concepts of prefabricated system and acquire knowledge about panel systems, slabs, used in precast construction	5, 7, 11	2,3
CO5	To acquire knowledge on design principles and to assess the connections used in precast construction	5, 7, 11	2,3
CO6	To acquire knowledge on codal provisions for designing.	5, 7, 11	2,3

MODULE – I

Fundamentals of Prestressed concrete: General principles of pre-stressing –pretensioning and post tensioning, Advantages and limitations of Prestressed concrete, Applications of Prestessed concrete Materials used and their characteristics, Necessity of using High strength concrete and high tensile steel.

Prestressing Methods: Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of Prestressing like Hoyer System, Magnet System, Freyssinet system and Gifford – Udall System.

MODULE – II

Losses in Prestressed concrete: Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of stress in steel, slip in anchorage, bending of member and frictional losses.IS recommendations for % loss in case of pre-tensioned and post-tensioned member, Simple Numerical problems.

MODULE – III

Analysis of Prestressed concrete members: Basic assumptions in analysis of Prestressed concrete beams, Elastic analysis of concrete beams Prestressed with straight, concentric, eccentric, bent and parabolic tendons and numerical problems. Simple steps involved in design of simply supported rectangular beam section (No numerical problems).

MODULE – IV

Introduction to prefabrication: Need for prefabrication – Principles of prefabrication – Modular coordination – Standardization – Materials – Systems – Production – Transportation – Erection.

Prefabricated Components: Behaviour and types of structural components – Large panel systems – roof and floor slabs -Walls panels – Beams – Columns – Shear walls.

MODULE – V

Design Principles: Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

Joints for different structural connections- Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connections between wall panels, Connections between floor panels. Design of expansion joints.
MODULE – VI
Design for Abnormal Loads: Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse.

Student Activity: Comparative analysis of Traditional vs prefabricated structures.

Text books:

1. Krishna Raju N., "Prestressed concrete", 6 th Edition, Tata McGraw Hill Company, New Delhi, 2018
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012
3. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers,USA,1991.
4. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
5. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.

Reference Books:

1. Ramamrutham S., “Prestressed Concrete”, Dhanpatrai Publications.
2. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
3. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
4. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6C4	Design of Steel Structures	3	1	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To acquire the knowledge on materials, specifications and various types of connections in steel structures	3,4,7	4, 5
CO2	To design of Steel beams in steel structures.	3,4,7	4, 5
CO3	To design and analyse the compression members as per IS 800	3,4,7	4, 5
CO4	To understand the designing of Un-stiffened and stiffened seated connections.	3,4,7	4, 5
CO5	To design the Plate girder with curtailment of flanges.	3,4,7	4, 5
CO6	To design the Gantry girder with curtailment of flanges.	3,4,7	4, 5

MODULE - I

Materials and Specifications: Making of iron and steel – types of structural steel – mechanical properties of steel – Concepts of plasticity - yield strength.

Loads and Load Combinations: Design Loads & load Combinations; Characteristic Loads, Partial safety factors for materials and loads.

Concept of limit State Design: Different Limit States as per IS 800 -2007 – Design Strengths- deflection limits – serviceability - Introduction, Behaviour of Bolted joints –– Design Strength – Efficiency of joint –- Design of Tension members. Introduction to Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of Welded joints - Weld symbols, Weld specifications, Effective areas of welds, Design Strength of members.

MODULE - II

Beams: Design of Beams – Plastic moment – Bending and shear strength laterally / supported beams design – Built up sections – large plates Web buckling Crippling and Deflection of beams, Design of Purlin.

MODULE - III

Compression Members: Design of compression members – Buckling class – slenderness ratio / strength design – Design of lacing and battens –column splice – column base – slab base.

MODULE - IV

Bolted and Welded Connections: Design of eccentric connections with brackets, Beam end connections – Web angle – Un-stiffened and stiffened seated connections (bolted and Welded types) Design of truss joints.

MODULE - V

Design Of Plate Girder: Design consideration – I S Code Recommendations Design of plate girder-Welded – Curtailment of flange plates stiffeners – splicing and connections.

MODULE - VI

Gantry Girder: Gantry girder impact factors – longitudinal forces, Design of Gantry girders.

Student Activity: Cost comparison report on steel and RC structures.

EXTERNAL EXAMINATION PATTERN: The end examination paper should consist of Part A and Part B. Part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions on design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Text Books:

1. Limit State Design of Steel Structures IS:800-2007, V.L.Shah and Veena Gore, Structures Publications, 2010.
2. Design of Steel Structures ,S.S.Bhavikatti , I.K. International Publishing House Limited, 2010.
3. Limit State Design of steel structures by S.K. Duggal, Tata Mcgraw Hill, New Delhi

Reference Books:

1. Structural Design and Drawing By N. Krishna Raju, University Press, Hyderabad
2. Comprehensive Design of Steel structures, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
3. Design of Steel Structures, N. Subramanian, Oxford University Press, 2010Relevant ISCodes
4. Structural design in steel by SarwarAlamRaz, New Age International Publishers, New Delhi
5. Design of steel structures by P. Dayaratnam
6. Design of steel structures by L.S. Negi
7. Design of Steel Structures by S. Ramamrutham and R. Narayanan

PROFESSIONAL ELECTIVE - 03

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6E1	Infrastructure Planning and Management	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the concepts related infrastructure like power stations, water supply and sanitation	1,9,11	2, 3
CO2	To acquire the knowledge on challenges faced by Urban and Rural Infrastructure in India.	1,9,11	2, 3
CO3	To learn the benefits of infrastructure privatization.	1,9,11	2, 3
CO4	To gain knowledge on Challenges in Privatization of infrastructure along with planning and implementation.	1,9,11	2, 3
CO5	To learn the strategies to implement successful Infrastructure Planning	1,9,11	2, 3
CO6	To know the concepts of capacity building in infrastructure implementation	1,9,11	2, 3

MODULE - I

An Overview Of Basic Concepts Related To Infrastructure: Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation, Tele communications Sector in India.

MODULE - II

Urban and Rural Infrastructure in India: an overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle, an overview of Infrastructure Project Finance.

MODULE - III

Private Involvement in Infrastructure: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply.

MODULE - IV

Challenges to Successful Infrastructure Planning and Implementation: Mapping and Facing the Landscape of Risks in Infrastructure Projects.

Case Study on Privatization of Infrastructure: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

MODULE - V

Economic and Demand Risks: The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in

Construction and Maintenance of Infrastructure. **Strategies For Successful Infrastructure Project Implementation:** Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.
MODULE - VI
Capacity Building: Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management Infrastructure Management Systems and Future Directions.

Student Activity: Report on role of infrastructure management in the development of nation.

Text Books:

1. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).
2. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).

Reference Books:

1. World Development Report 1994: Infrastructure for Development (1994).
2. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990).
3. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September (2000).

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6E2	Design of Bridges	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To acquire the knowledge on components of bridge, bearings, piers& abutments, IRC loadings.	4, 6	4, 5
CO2	To analyze and design of reinforced concrete bridges such as deck slab bridge, Box culvert, T – Beam Bridge, Plate girder bridge etc., based on the I.R.C provisions.	4, 6	4, 5
CO3	To make the student to design a bridge independently as per the I.R.C provisions.	4, 6	4, 5
CO4	To get the knowledge of supported bridges and bridge bearings and cable	4, 6	4, 5
CO5	To design the plate girder bridge and substructure for bridges like abutments and piers	4, 6	4, 5
CO6	To know the bridge bearings and cable supported bridges	4, 6	4, 5

MODULE - I

Introduction: Definition, components of a bridge, classifications, importance of bridge Investigation of Bridges: Need for investigations, selection of bridge site, preliminary data to be collected, I.R.C. Specifications for Road Bridges, Standard live loads, other forces acting on bridges, Impact factor.

MODULE - II

Design of deck slab: Design of deck Slab Bridge (Simply supported) subjected to class AA Tracked Vehicle only.

MODULE - III

Design of Box culverts: General aspects. Design loads, Design of Box culvert subjected to class AA tracked vehicle only.

MODULE - IV

Design of T-Beam Bridge: Design of interior panel of slab – Pigeauds method for computation of slab moments– courbon's method for computation of moments in girders. Design of a T-beam bridge subjected to class AA tracked vehicle only.

MODULE - V

Design of Plate Girder Bridge: Design of a Deck type welded plate girder – Bridge of single line B.G.

Substructure for bridges: Materials for piers &Abutments, Types of piers, Forces acting on piers - Stability analysis of piers – General features of Abutments – forces acting on abutments – Design of abutment – Types of wing walls –Approaches

MODULE - VI

Cable Supported Bridge: suspension bridge vs cable stayed bridge. Various components and factors to be considered for design of suspension bridge and cable stayed bridge, types of cable supported bridges

Bridge bearings: Importance of bearings, Types of Bearings, Design of Elastomeric pad Bearing.

Student Activity: Design and Preparation of prototypes of various types of bridges

Text Books:

1. Krishna Raju. N "Design of Bridges", Oxford and IBH Publishing Co., New Delhi, 2015, 5 th Edition.
2. Jagadeesh, T.R and Jayaram, M.A., "Design of Bridge Structures". PHI Learning Private Ltd., New Delhi, 2009.
3. Johnson Victor D., "Essentials of Bridge Engineering", 6th Edition, Oxford and IBH Publishing Co., New Delhi, 2017

Reference Books:

1. Bridge Engineering by Ponnu Swamy, TATA Mc graw Hill Company, New Delhi.Relevant – IRC & Railway bridge Codes.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6E3	Advanced Reinforced Concrete Structures	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To analyse and design the flat slabs with and without drop and column head.	4, 7	4, 5
CO2	To analyse and design Bunkers and Silos.	4, 7	4, 5
CO3	To design the water tank resting on the ground with reinforcement details based on design requirements.	4, 7	4, 5
CO4	To design of rectangular water tank resting on the ground.	4, 7	4, 5
CO5	To analyse and design the retaining walls and concrete corbels.	4, 7	4, 5
CO6	To analyse and design the shear walls and concrete chimneys.	4, 7	4, 5

MODULE - I

Design of a flat slab: Introduction, Slabs without drop and column head, Slabs with drop and column head Slabs without drop and column with column head, Slabs with drop and column without column head, proportioning of flat slabs, Design of interior panel slab by IS456:2000 and sketchup the reinforcement details.

MODULE - II

Bunkers & silos: Introduction, Difference between bunkers and silos, Design of concrete bunkers of circular shape.

MODULE - III

Water Tanks; Introduction, design requirements, reinforcement details, Design of circular water tank resting on the ground.

MODULE - IV

Design of rectangular water tank resting on the ground

A) For tanks with ratio L/B less than 2

B) For tanks with ratio L/B greater than 2

MODULE - V

Design of Retaining walls: Introduction, Types of retaining walls, earth pressures, soil reaction on toe & heel slab, Stability requirements**,** Design of cantilever and counter forte retaining wall with horizontal back fill.

Design of concrete corbels: Introduction, Load transfer, Analysis and design of concrete corbels

MODULE - VI

Design of shear walls: Introduction - Classification of shear walls - Classification according to behavior - Loads in shear walls - Design of Rectangular and flanged shear walls - formula for moment of Resistance of Rectangular shear walls. Design and detailing of Concrete Chimneys.

Students Activity: Design of various structural elements mentioned in syllabus and provide detailed drawings with specifications.

Text Books:

1. Varghese P.C., "Advanced Reinforced Concrete Design", Prentice Hall India, 2007.
2. Krishnaraju N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, 2016

Reference Books:

1. Sinha N. C. and Roy S.K., "Fundamentals of Reinforced Concrete", S.Chand Company, 2013.
2. Ashok. K. Jain, "Reinforced Concrete Design", Nem Chand & Brothers -Roorkee , 2012.

Reference Codes:

1. Code of practice for Plain and Reinforced Concrete IS456-2000, BIS, New Delhi.
2. Design Aids for Reinforced Concrete to IS 456, Special Publication (SP16), BIS New Delhi,1980.

OPEN ELECTIVE - 03

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6O1	Environmental Pollution and control	2	0	0	2	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards.	2, 3, 7	2, 3
CO2	To understand the importance of treatment process of industrial effluents.	2, 3, 7	2, 3
CO3	To know the classification, separation and procession of the solid waste.	2, 3, 7	2, 3
CO4	To understand different types of Hazardous wastes, their Disposal and Control methods.	2, 3, 7	2, 3
CO5	To Understand the importance of hygienic environment.	2, 3, 7	2, 3
CO6	To know the importance of sustainable development while planning a project or executing an activity.	2, 3, 7	2, 3

MODULE – I

Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

MODULE – II

Industrial waste water Management: Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

MODULE – III

Solid Waste Management: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

MODULE – IV

Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

MODULE – V

Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

MODULE – VI
Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development.

Student Activity: Prepare a detailed report on various Sustainable Development Goals of India.

Text Books:

1. Peavy, H. S., Rowe, D.R, Tchobanoglous, "Environmental Engineering", G.Mc-Graw Hill International Editions, New York 1985.
2. J. G. Henry and G.W. Heinke, "Environmental Science and Engineering", Pearson Education.

Reference Books:

1. G. L. Karia and R.A. Christian, "Waste water treatment- concepts and design approach", Prentice Hall of India
2. 2. M. N. Rao and H. V. N. Rao, "Air pollution", Tata Mc.Graw Hill Company.
3. Ruth F. "Weiner and Robin Matthews Environmental Engineering", 4th Edition Elesevier, 2003.
4. 4. K. V. S. G. Murali Krishna, "Air Pollution and Control" by, Kousal & Co. Publications, New Delhi.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6P1	Computer Aided Building Planning & Design Laboratory	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To prepare, read, understand and interpret the drawings in a professional manner.	5, 9,11	3, 4
CO2	To plan and design a residential or public building as per the given requirements with CAD software.	5, 9,11	3, 4

Basics of AUTOCAD:
Drawing tools: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse
Modifying tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet
Using Text: Single line text, Multiline text, Spelling, Edit text
Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, working with multiple drawings.
Building Drawings:
Understanding and drawing of structural/constructional drawings(For more practical and hands on experience students are encouraged for field visit)
a) Site Layout Plan
b) Floor Plan
c) Foundation and Column Layout Drawings
d) Plinth Beam Layout Drawings
e) Roof beam details
f) Roof slab details
g) Flooring Details Drawings
h) Doors & Windows Frame Details
i) Sill and Lintel Level Drawings
j) Staircase Layout and Reinforcement Details
k) Plumbing & Electrical Layout Drawings

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6P2	Construction Project management Software Laboratory	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain knowledge in utilizing the sophisticated spread sheets programs, estimation software and other package programs.	5, 9,11	4, 5
CO2	To prepare the Scheduling of a Small Construction Project By using Primavera.	5, 9,11	4, 5
CO3	To understand the simulation models for Project Risk Analysis.	5, 9,11	4, 5
CO4	To identify the time estimates for activities and estimation for apartment with framed structure.	5, 9,11	4, 5

Microsoft project:

1. Setting up a project and creating calendars.
2. Creating WBS
3. Defining tasks and relationships.
4. Resource Addition and Modification
5. Project Scheduling.

Primavera - P6

1. Creation of the project, EPS, OBS and WBS.
2. Setting up of interrelationships between activities
3. Resource Addition and Modification
4. Project Scheduling
5. Resource Levelling
6. Preparation of Histograms and S-curve graphs
7. Creation and Maintenance of base line

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6K1	Skill/Job Oriented Course-04	0	2	0	2	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To create basic building model with all its components.	5,9,11	2, 3

Google SketchUp software

The student must learn **Google SketchUp software** course as per the guidelines prescribed by the concerned department.

Suggested Input Learnings:

1. Getting Started
2. Setting Up the Template
3. Understanding The Layout
4. Toolbar
5. Navigating in 3D
6. Toolbar Description
7. Creating Basic Shapes
8. Creating and Placing 3D Text
9. Grouping and Components
10. Exporting as an STL File
11. Saving

Note:

1. The Departmental head will instruct the students, whether the course is to be done either in offline or online mode, at the starting of the semester.
2. If the course is to be done in online mode, the generated certificate after successful completion of course should be produced in the concerned department. The marks will be awarded on the basis of certificate produced and Viva voce.
3. If the course is to be done in offline mode, then the course instructor allotted by the department head should award marks based on internal assessment such as submissions, performance, viva voce etc.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VI	CT21B6TS	Technical Seminar	0	2	0	1	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To demonstrate public speaking with the aid of Power Point Presentations.	9,10,11	6
CO2	To identify current general and specific technological topics of interest and prepare and present the content cogently.	9,10,11	6
CO3	To demonstrate communication skills and interview performance skills.	9,10,11	6

Procedure:

7. Seminar in-charges shall highlight the significance of technical seminar in the first two sessions and enlighten the students on the utility of these seminars.
8. The slots, titles shall be decided upfront and seminar in charge shall take signatures.
9. The same sheet shall be affixed in the respective classrooms and seminar register.
10. Progress of the seminars is reviewed by the concerned Departmental Head once in 15 days.
11. The evaluation for technical seminars is informed to students and displayed in the classrooms.
12. The presentation (PPT) must contain topic, introduction, explanation, diagrams, tables, applications and conclusions.

Distribution of marks

There shall be a Technical Paper writing and seminar evaluated for 100 marks The evaluation is purely internal and will be conducted as follows:

Content	: 20 marks
Presentation including PPT	: 20 marks
Seminar Notes	: 10 marks
Interaction	: 10 marks
Report	: 25 marks
Attendance	: 10 marks
Punctuality	: 5 marks
Total	**100 marks**

SEMESTER VII

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7C1	Construction Accounts and Financial Management	4	0	0	4	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain the knowledge on different concepts of finance cost accounting.	6,9,11	2, 3
CO2	To know the importance of budgeting and preparation of budget report for various construction projects.	6,9,11	2, 3
CO3	To understand various methods for evaluation of Investment proposals.	6,9,11	2, 3
CO4	To acquire knowledge on various concepts related to cost management in construction projects.	6,9,11	2, 3
CO5	To analyse the methods of depreciation and preparation of Contract Accounts for construction projects.	6,9,11	2, 3
CO6	To analyse and assess the financial position and forecasting of cash flows construction projects.	6,9,11	2, 3

MODULE - I

Financial Accounting: Basic Concept – Definitions of Book Keeping and Accounting – Objectives and Functions of Accounting – Types of Accounts – Rules of Debit and Credit, Journal – Ledger – Trial Balance.

Preparation of Final Accounts – Adjusting Entry – Trading, Profit and Loss Account and Balance Sheet.

MODULE - II

Budget: Meaning and definitions – Preparation of Functional Budgets – Cash Budget - Sales Budget – Purchases and Production Budget – Flexible Budget.

Capital Budgeting: Nature, Importance and Objectives – Process involved in Capital Budgeting – Kinds of Capital Budgeting Decision.

MODULE - III

Methods of Evaluating Investment Proposals – Payback method – Payback profitability method – Discounted Cash Flow method – Net present – Value method.

MODULE - IV

Project Cost Management: Project Cost Management, Resources Planning Schedules, Cost Planning, Cost Budgeting, Cost Control, Collection Of Cost-Related Information - Labour Cost, Material Cost, Plant and Equipment Cost, Subcontractor Cost, Overhead Cost, Cost Codes, Cost Statement.

MODULE - V

Project Accounts: Preparation of Contract Accounts for each project – Methods of Recording and

Reporting Site Accounts to Project Office and from Project Office to Head Office.

Depreciation: Introduction, Methods of Depreciation, Straight Line Method of Depreciation, Declining Balance Method of Depreciation, Sum-of-the-Years-Digits Method of Depreciation, Sinking Fund Method of Depreciation, Service Output Method of Depreciation.

MODULE - VI

Tools for financial analysis: Ratio analysis for financial conditions, Ratio analysis for financial performance, five basic types of ratios – Liquidity, Leverage coverage, Activity and Profitability.

Cash flow forecasting of projects: Prerequisites for each cash flow forecasting, preparation cash flow statements. Use of S-curve. Composite cash flow statements, cost of borrowing self-financing contracts.

Students Activity: Prepare a cash flow statement with all required details for a sample project along with S-curve.

Text Books

1. Bhattacharya S.K. and Dearden John, "Accounting for Management", Vani Educational Books, Mumbai (Latest Edition).
2. Saravanvel P. "Management Accounting" Principles and Practices.

Reference Books:

1. B.S. Raman "Accountancy".
2. Prof. K.S. Nagapathi, "Management Accounting" R. Chand and Co., New Delhi.
3. Kuchal S.C. "Corporate Finance", Tata McGraw Hill, New Delhi

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7C2	Construction Contracts & Specifications	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know the steps involved in preparing contracts, various types of contracts.	8, 10, 11	2,3
CO2	To understand the purpose of valuation of building and can select the tendering process for awarding of construction contracts.	8, 10, 11	2,3
CO3	To assess the performance of contracts in construction industry.	8, 10, 11	2,3
CO4	To acquire the knowledge on breaches of contracts.	8, 10, 11	2,3
CO5	Apply the knowledge of resolution technique in resolving disputes in construction industry.	8, 10, 11	2,3
CO6	To analyses the importance and need of contract documents and management.	8, 10, 11	2,3

MODULE - I

Introduction to contracts: Definitions, Types of contracts - Formation of contract - Contract conditions, Essentials for a legally valid contract, Salient features of a contract, Discharging of a contract, Documents for an Engineering Contract; Types of contracts: Classification Based on − Tendering Process, Economic Consideration, Tasks Involved; Main and Sub Contracts, Features, Merits, Demerits – Indian Contract act and arbitration act.

MODULE - II

Valuation: Introduction& purpose of valuation - Types of valuation -year's purchase, gross and net income, Valuation methods , Fixation of rent - problem - depreciation- − Mortgage – Lease

Tendering process: Definitions, List of Documents, EMD, SD, Preparation of Enquiry Documents, Invitation for Tenders, Preparation of Tender Documents and its submission, Receipt of Tender Documents and its opening, Evaluation of Tender and Award of contract – Letter of Award, Letter of Intent, Issues in tendering process: Pre - Registration, Pre – Qualification, Nominated Tendering, Rejection of Tenders.

MODULE - III

Administration/Performance of contract: Responsibilities (Duties and Liabilities) of Principal & Contractor, Settlement of claims − Advances, Bills, Extension for time, Extras & Variations, Cost Escalations. Security Deposit, Retention Money, PerformanceBond.

MODULE - IV

Breach of contract: Definition and Classification, Common Breaches by – Principal, Contractor, Damage Assessment, Claims for Damages, Quantum Meruit, Force Majeure or Frustration.

MODULE - V
Dispute resolution: General, Methods for dispute resolution − Negotiations, Mediation, Conciliation, Dispute Resolution Boards, Arbitration, Litigation/Adjudication by courts. Conciliation − Appointment of Conciliator, Role of Conciliator. Arbitration – Arbitration Agreement, Terms of Reference, Arbitrator's Powers, Revocation ofArbitrator − Misconduct of Arbitrator. Case Studies.
MODULE - VI
EPC Contracts: Turnkey and BOT family contracts, study of all these forms of contracts, financial agreements roles and responsibilities of parties, contract risk. Contract administration process from predesign phase of project to the closure of the project and step by stepflow process.

Students Activity: Prepare a tender document with all required clauses for a sample project. A capstone project on the contractual process and making of contractual document

Text Books:

1. Prakash V. A.,(1997) "Contracts Management in Civil Engineering Projects", NICMAR
2. Patil B. S.,(2009) "Civil Engineering Contracts and Estimates", University Press.

Reference Books:

1. John G. Betty(1993/ Latest Edition) "Engineering Contracts", McGraw Hills.
2. Gt Gajria's "Law Relating to Building and Engineering Contracts in India" 2000
3. Albett Robert W., (1961/ Latest Edition) "Engineering Contracts and Specifications", John Willey and Sons, New York.
4. Vaid K.N., (1998)"Global perspective on International Construction Contracting Technology and Project Management", NICMAR, Mumbai.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7C3	Risk Management in Construction	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain knowledge on the concepts of risk identification management.	7,10,11	2,3
CO2	To understand and evaluate the risk measurement by various Risk Management Decision Methods.	7,10,11	2,3
CO3	To gain knowledge about types of insurance, framework & duties of IRDA.	7,10,11	2,3
CO4	To know the basic features of general insurance, laws & risks involved.	7,10,11	2,3
CO5	To know the functional management & structure of insurance companies.	7,10,11	2,3
CO6	To know various government regulations related to insurance & issues.	7,10,11	2,3

MODULE – I

Introduction to Risk Management: Risk-Risk and Uncertainty-Types of Risk-Burden of Risk-Sources of Risk-Methods of handling Risk-Degree of Risk-Management of Risk.

Risk Identification: Risk Identification- Business Risk Exposures-Individual Exposures-Exposures of Physical Assets -Exposures of Financial Assets -Exposures of Human Assets - Exposures to Legal Liability - Exposure to Work-Related Injury.

MODULE – II

Risk Measurement: Evaluating the Frequency and Severity of Losses-Risk Control-Risk Financing Techniques-Risk Management Decision Methods- -Financial Analysis in Risk Management -- Decision Making Other Risk Management Tools.

MODULE – III

Introduction to Insurance: Types of Insurance-Essentials of Insurance Contracts. Indian Insurance Industry -Historical Framework of Insurance, Insurance sector Reforms in India. IRDA-Duties and powers of IRDA-IRDA Act 1999. (Theory).

MODULE – IV

General Insurance: Laws Related to General Insurance-General Insurance Contract- Fire Insurance-Essentials of Fire Insurance Contracts, Types of Fire Insurance Policies, Fire Insurance Coverage. Marine Insurance-Types of Marine Insurance – Marine Insurance principles Important Clauses in Marine Insurance– Marine Insurance Policies –Marine Risks-Clauses in Marine Policy.

MODULE – V

Management of Insurance Companies Functions and Organization of Insurers: Types of Insurance Organization, Organizational Structure of Insurance Companies-Functions of Insurers. Underwriting-Principles of Underwriting, Underwriting in Life Insurance, Underwriting in nonlife Insurance. Claims Management-Claim Settlement in General Insurance- Claim Settlement in Life Insurance.

MODULE – VI
Government Regulation of Insurance: Reasons for Insurance Regulation- Historical Development of Insurance Regulation - Methods for Regulating Insurers - Regulated areas - State Versus Federal Regulation - Current Problems and Issues in Insurance Regulation.

Student Activity: Report on risk management plan of a sample project.

Text Books:

1. Principles of Risk Management and Insurance, George E Rejda, (2009),Twelfth Edition, Pearson, New Delhi.
2. Insurance and Risk Management, P.K. Gupta, (2010), First Edition, Himalaya Publishing House, Mumbai.
3. Introduction to Risk Management and Insurance, Dorfman, Mark S., (2008), 10th Edition, Prentice Hall India, New Delhi.

Reference Books:

1. Risk Management and Insurance, Scott E. Harrington, Gregory R Niehaus, (2007), Second Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Principles and Practice of Insurance, P. Periasamy, (2009), Second Edition, Himalaya Publishing House, Mumbai.
3. Risk Management and Insurance, C. Arthur Williams, Jr. Peter Young, Michael Smith, (2007), Eighth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi

PROFESSIONAL ELECTIVE - 04

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7C4	Repair, Rehabilitation and Retrofitting of Concrete Structures	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand various concepts of Repair, Retrofitting, & rehabilitation and causes of failure of structures and their prevention.	5,7,11	2,3
CO2	To understand the causes of corrosion of Steel Reinforcement and preventive measures.	5,7,11	2,3
CO3	To assess the strength and deficiency of materials in concrete structures.	5,7,11	2,3
CO4	To apply Non Destructive Testing techniques to field problems and cost effective retrofitting strategies for repairs in buildings.	5,7,11	2,3
CO5	To understand and analyse various materials and techniques used in repairing / strengthening existing concrete structures.	5,7,11	2,3
CO6	To apply the concepts related to Jacketing & Strengthening of beams & columns to various field problems and can assess the need of Structural Health Monitoring.	5,7,11	2,3

MODULE - I

Introduction: Definition and concepts related to Repair, Retrofitting, and rehabilitation, need for rehabilitation of structures, Deterioration of Structures -Distress in Structures- Causes and Prevention of distress and deterioration in the structures.

MODULE - II

Corrosion of Steel Reinforcement: Definition of corrosion, Causes for corrosion in RCC, Mechanism of corrosion and methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

MODULE - III

Damage diagnosis and assessment: Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing.

MODULE - IV

Maintenance and Repair Strategies: Inspection, Structural Appraisal, Economic Appraisal, Components

of Equality Assurance, Conceptual Bases for Quality Assurance Schemes.
MODULE - V
Materials For Repair: Special Concretes and Mortar, Concrete Chemicals, Special Elements For Accelerated Strength Gain, Expansive Cement, Polymer Concrete, Sulphur Infiltrated Concrete, Ferro Cement, Fibre Reinforced Concrete. **Techniques For Repair**: Rust Eliminators And Polymers Coating For Rebars During Repair, Foamed Concrete, Mortar And Dry Pack, Vacuum Concrete, Gunite And Shotcrete, Mortar Repair For Cracks, Shoring And Underpinning.
MODULE - VI
Jacketing: Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing. **Strengthening:** Strengthening, Beam shear strengthening, Column strengthing, Flexural strengthening. **Structural Health Monitoring:** Definition, need for continuous, monitoring of structures, Components of SHM, Use of Sensors – Building Instrumentation.

Student Activity: A Case study should be carried out on deterioration of structures, distress in structures, corrosion induced structures etc., and a document should be submitted with suitable methodology for identified problem.

Text Books:

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.

Reference Books:

1. Defects and Deterioration in Buildings, EF & N Spon, London
2. Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press
3. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W.H. Ranso
4. Earthquake Resistant Design Of Structures By Pankaj Agarwal And Manish Shrikhande, Prentice-Hall Of India, 2006.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7E2	Earthquake Resistant Design and Construction	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know the concepts related to earthquake and its effect on different engineering structures.	5,7,11	2
CO2	To gain knowledge on seismic effect on structures and analyze the effect of Deformations in Structures.	5,7,11	2
CO3	To understand the effects of architectural design of buildings during earth quakes and design philosophies to counteract.	5,7,11	2
CO4	To assess seismic performance of reinforced concrete buildings along with influence on various structural elements.	5,7,11	2
CO5	To understand the effect of earthquake on buildings and design of earthquake resistant buildings.	5,7,11	2
CO6	To assess seismic performance of ductile and brick masonry buildings.	5,7,11	2

MODULE - I

Introduction to Earth Quake: Earth and its interior, Local Convective Currents in the Mantle, Plate Tectonics, The Earthquake(Elastic Strain Build-Up and Brittle Rupture, Elastic Rebound Theory with neat sketches) Types of Earthquakes and Faults, Seismic waves with neat sketches, measuring Instrument (seismograph), Schematic of Early Seismograph, Strong Ground Motions and its characteristics.

Basic Terminology: Terms associated with earthquakes with neat sketches, magnitude, intensity, Basic Difference! Magnitude versus Intensity, Magnitude and Intensity in Seismic Design, Seismic zones of India.

MODULE - II

Seismic Effects on Structures: Inertia Forces in Structures and schematic representation of Effect of Inertia in a building when shaken at its base, Effect of Deformations in Structures with neat sketches, Horizontal and Vertical Shaking with neat sketches, Flow of Inertia Forces to Foundations with neat sketches.

MODULE - III

Architectural Features Affect Buildings During Earthquakes: Importance of Architectural Features, Architectural Features, Size of Buildings, Horizontal Layout of Buildings with neat sketches, Vertical Layout of Buildings & Adjacency of Buildings with neat sketches, Building Design and Codes.

MODULE - IV

Twist of Buildings During Earthquakes: Why a Building Twists, What Twist does to Building Members.

Seismic Design Philosophy for Buildings: The Earthquake Problem, Earthquake-Resistant Buildings, Earthquake Design Philosophy, Damage in Buildings: Unavoidable, Acceptable Damage: Ductility.

MODULE - V
Ductile Buildings for Good Seismic Performance: Construction Materials, Capacity Design Concept, Tension Test on Materials - ductile versus brittle materials. Ductile chain design, Earthquake-Resistant Design of Buildings, Quality Control in Construction. **Flexibility of Buildings Affects their Earthquake Response:** Oscillations of Flexible Buildings, Importance of Flexibility.
MODULE - VI
Brick masonry houses behavior during earthquakes: Behaviour of Brick Masonry Walls, How to Improve Behaviour of Masonry Walls, Choice and Quality of Building Materials, Box Action in Masonry Buildings, Influence of Openings, Earthquake-Resistant Features **Necessity of horizontal bands in masonry buildings:** Role of Horizontal Bands, Design of Lintel Bands **Vertical reinforcement required in masonry buildings:** Response of Masonry Walls, How Vertical Reinforcement Helps, Protection of Openings in Walls.

Student Activity: A report on history of seismic failures of high rise buildings in India.

Text Books:

1. Earthquake Tips – Learning Earthquake Design and Construction C. V. R. Murty
2. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
3. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
2. Masory and Timber structures including earthquake Resistant Design – Anand S.Arya, Nemchand & Bros
3. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial College Press.
4. Earthquake Tips – Learning Earthquake Design and Construction C. V. R. Murty

Reference Codes:

1. IS: 1893 (Part-1) -2016. "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS: 4326-1993, "Earthquake Resistant Design and Construction of Building", Code of Practice B.I.S., New Delhi.
3. IS: 13920- 2016, "Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7E3	Urban Transportation Planning	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the concept of travel demand and characteristics.	3,4,11	2,3
CO2	To know the different types of transportation planning processes.	3,4,11	2,3
CO3	To understand different types of surveys for zoning.	3,4,11	2,3
CO4	To know various types of trip generation models.	3,4,11	2,3
CO5	To know the necessity of traffic assignment and mode split.	3,4,11	2,3
CO6	To understand the economic evaluation of transportation projects.	3,4,11	2, 3

MODULE – I

Concept Of Travel Demand: Travel Characteristics - Origin, Destination, Route, Mode, Purpose; Travel Demand As A Function Of Independent Variables; Assumptions In Demand Estimation Relation Between Land Use And Travel; Four Step Process Of Transportation Planning.

MODULE – II

Transportation Planning Process: General Concept Of Trip; Trip Generation; Trip Distribution, Traffic Assignment And Mode Split, Aggregate And Disaggregate Models. Date Collection And Sequential And Sequential Recursive Models. Date Collection And Inverntories; Definition Of Study Area;

MODULE – III

Zoning Principles: Types And Sources Of Data, Home Interview Surveys; Road Side Interview Surveys; Goods. Taxi, IPT Surveys; Sampling Techniques; Expansion Factors And Accuracy Check; Desire Line Diagram And Use.

MODULE – IV

Trip Generation Models: Factors Governing Trip Generation And Attraction; Multiple Linear Regression Models, Category Analysis, Trip Distribution Models Methods Of Trip Distribution; Growth Factor Models Uniform Growth Factor Method; Average Growth Factor Method; Factor Method; Furnes Method; Limitation Of Growth Factor Models Concept Of Gravity Model.

MODULE – V

Traffic assignment and Mode Split: Purpose of Assignment and General Principles; Assignment Techniques - All - or- nothing. Assignment; Multiple route assignment, Capacity restraint method. Minimum path trees; Diversion Curves. Factors affecting mode split; probit, logit and discriminant Analysis.

MODULE – VI
Economic Evaluation of Transportation plans: Costs And Benefits Of Transportation Projects; Vehicle Operating Cost; Timesaving Accident Costs. Methods Of Economic Evaluation - Benefit Cost Ratio Method; Net Present Value Method; Internal Rate Of Return Method.

Student Activity: A report on various types of sources of Data collection with the help of various types of surveys.

Text Books:

1. L.R.Kadiyalli; Traffic Engineering and Transporation Planning Khanna Publishers, Delhi.
2. Papacostas, C.S., and Prevedouros,P.D.(2002). Transportation Engineering and Planning. 3rd Edition, Prentice - Hall of India Pvt Ltd., 318-436

Reference Books:

1. Khistry C.J.Transportation Engineering -An Introduction Prentic Hall.
2. Adib Kanafani.(1983). Transportation Demand Analysis. Mc Graw Hill Series in Transportation, Berkeley.
3. Hutchinson,B.G.(1974).Principles of Urban Transport Systems Planning. Mc Graw Hill Book Company, New York.
4. John W.Dickey.(1975). Metropolitan Transportation Planning. Mc Graw Hill Book Company, New York.

PROFESSIONAL ELECTIVE - 05

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7E4	Lean Construction Techniques	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand the basic concepts of lean construction in various projects.	5,7,11	2,3
CO2	To gain knowledge on different phases of construction projects.	5,7,11	2,3
CO3	To know the basics of lean management principles from manufacturing industry to construction industry.	5,7,11	2,3
CO4	To have better understanding of core concepts of lean construction tools.	5,7,11	2,3
CO5	To apply lean construction tools and techniques to achieve better productivity in construction projects.	5,7,11	2,3
CO6	To apply lean construction techniques in design and modelling.	5,7,11	2,3

MODULE - I

INTRODUCTION: Introduction and overview of the construction project management -Review of Project Management& Productivity Measurement Systems – Productivity in Construction– Daily Progress Report- The state of the industry with respect to its management practices.

MODULE - II

Construction Project Phases: construction project phases - Essential features of contemporary construction management techniques - The problems with current construction management techniques– Current production planning.

MODULE - III

Lean Management: Introduction to lean management – Toyota's management principle-Evolution of lean in construction industry - Production theories in construction –Lean construction value - Value in construction - Target value design – Lean project delivery system- Forms of waste in construction industry – Waste Elimination.

Core Concepts In Lean: Concepts in lean thinking – Principles of lean construction – Variability and its impact – Traditional construction and lean construction – Traditional project delivery - Lean construction and workflow reliability – Work structuring – Production control.

MODULE - IV

Lean Construction Tools: Value Stream Mapping – Work sampling – Last planner system – Flow and pull based production – Last Planner System – Look ahead schedule – constraint analysis – weekly planning meeting- Daily Huddles – Root cause analysis – Continuous improvement – Just in time.

MODULE - V

Lean Construction Techniques: Lean construction techniques such as Waste avoidance and reduction, partnering, Target Value Design and Set Based Design, Pull Planning and Last Planner System, Continuous improvement.
MODULE - VI
Lean Construction Implementation: Lean construction implementation- Enabling lean through information technology – Lean in design - Design Structure- Matrix Location Based Management System- BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach. **Lean Project Delivery:** Lean project delivery, value of lean for design and construction organizations, implementation issues, drivers and barriers to lean implementation in the construction sector.

Students Activity: Students must develop Lean construction management plan for a sample project

Text Books:

1. Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.
2. Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.
3. Alarcon, L. (1997), Lean Construction, Taylor and Francis
4. Freddy Balle, Michael Balle, Liker Jeffrey (2011) The Lean Manager: A Novel of Lean Transformation, Lean Enterprise Institute, Inc.

Reference Books:

1. Dave, B., Koskela, L., Kiviniemi, A., Owen, R., andTzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.
4. James Womack and Daniel Jones, Lean Solutions: How Companies and Customers Can Create Value and Wealth Together, Simon and Schuster, New York, NY. 2005
5. James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed the World, MacMillan Publishing, New York, NY. 1990

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7E5	Climate Change and Sustainable Development	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able to		
CO1	To identify the factors influencing the climate system on the Earth.	1, 7,11	2,3
CO2	To understand various concepts of Changes in patterns of temperature, precipitation and sea level rise	1, 7,11	2,3
CO3	To analyse and assess the Causes of global climate systems on global, regional and local scales.	1, 7,11	2,3
CO4	To analyse and assess the impact of global climate systems on global, regional and local scales.	1, 7,11	2,3
CO5	To develop the Strategies for adaptation of climate change and various mitigation measures.	1, 7,11	2,3
CO6	To analyse and assess the mechanisms of Energy and clean technologies for sustainable development	1, 7,11	2,3

MODULE - I

Earth's Climate System: Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes – The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation - The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

MODULE - II

Climate Changes: Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability.

MODULE - III

Causes of Climate Changes: Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modelling.

MODULE - IV

Impacts Of Climate Change: Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

MODULE - V

Climate Change Adaptation: Strategy/Options in various sectors – Water – Agriculture –- Infrastructure

and Settlement including coastal zones – Human Health – Tourism – Transport – Energy. **Climate Change Mitigation Measures Adaptation:** Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.
MODULE - VI
Clean Technology: Clean Development Mechanism –Carbon Trading- examples of future Clean Technology. **Energy:** Biodiesel – Natural Compost – Eco-Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydropower – Mitigation Efforts in India and Adaptation funding.

Students Activity: Submit a report on adverse effects of climate change on various engineering structures and provide remedial measures.

Text books:

1. Anil Markandya, Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002
2. Heal, G. M., Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty, Kluwer Academic Publ., 1998

Reference Books:

1. Jepma, C.J., and Munasinghe, M., Climate Change Policy – Facts, Issues and Analysis, Cambridge University Press, 1998
2. Munasinghe, M., Sustainable Energy Development: Issues and Policy in Energy, Environment and Economy: Asian Perspective, Kleindorfor P. R. et. al (ed.), Edward Elgar, 1996
3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd 2007

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7E6	Research Methodology & IPR	3	0	0	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To identify the research problem, research gap and Literature study approaches, plagiarism.	8, 9,10	1, 2
CO2	To get knowledge on literature of studies , plagiarism and research ethics	8, 9,10	1, 2
CO3	To get knowledge about technical writing of a report.	8, 9,10	1, 2
CO4	To understand the Nature of intellectual property.	8, 9,10	1, 2
CO5	To know about patent drafting and filling patents.	8, 9,10	1, 2
CO6	To identify the new developments in IPR	8, 9,10	1, 2

MODULE - I

Identifying Research Problem: Meaning of Research problem, Sources of research problem, Criteria Characteristics of a good research problem. Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solution for research problem, data collection, analysis, interpretation, Necessary instrumentations.

MODULE - II

Literature Study: Effective literature studies approaches, analysis, plagiarism and Research ethics.

MODULE - III

Technical Report Writing: Effective Technical Writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a Presentation and assessment by a review.

Writing a research proposal, objectives of study, hypothesis to be tested, study design, Measurement procedures, Ethical issues, Sampling, Analysis of data.

MODULE - IV

Nature of intellectual Property: Patents, Designs, Trade and copyright. Process of patenting and Development: technical research, innovation, patenting, development. International scenario: International cooperation on intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE - V

Patent Rights: Scope of patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical indications.

MODULE - VI

New development in IPR: Administration of patent system, IPR of Biological systems, Computer software etc**.** Traditional Knowledge case studies, IPR and IIT's.

Students Activity: Students must prepare and submit technical Presentation report on desired topic related to their domain.

Text Books:

1. A text book of "Research Methodology: A step by step guide for beginners" by Ranjith Kumar.
2. Research Methodology : Methods And Techniques by C.R. Kothari , Gaurav Garg

Reference Books:

1. Halbert, "Resisting Intellectual Property", taylor and Francis Ltd, 2007.

OPEN ELECTIVE - 04

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7O1	Disaster Management and Mitigation	2	0	0	2	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know about various environmental disasters, hazards & relation with Human ecology	1, 7	2, 3
CO2	To know about occurrences of various disasters & hazards	1, 7	2, 3
CO3	To know about the endogenous hazards & its prevention methods, risk management & rehabilitation methods	1, 7	2, 3
CO4	To know about exogeneous disasters, hazards & its control measures, preventive measures.	1, 7	2, 3
CO5	To know about soil erosion, prevention measures, control measures	1, 7	2, 3
CO6	To know about disasters & its stages- occurences, control measures, prevention measures, & rehabilitation	1, 7	2, 3

MODULE – I

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology – Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

MODULE – II

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

MODULE – III

Endogenous Hazards: Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes – Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake.

MODULE – IV
Exogenous hazards/ disasters: Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes, distribution human adjustment, perception & mitigation) Cumulative atmospheric hazards/ disasters: Floods - Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/Disasters- Man induced Hazards /Disasters- Physical hazards/ Disasters.+
MODULE – V
Soil Erosion: Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion, Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters: Population Explosion.
MODULE – VI
Emerging Approaches in Disaster Management: Three Stages 1. Pre-disaster stage (Preparedness) 2. Emergency stage 3. Post-disaster stage – Rehabilitation

Student Activity: A report on Preparedness, Emergency stage and Rehabilitation of any Endogenous or Exogenous Hazards/Disasters.

Text Books:

1. Disaster Management by Rajib Shah, Universities Press, India, 2003.
2. Disaster Mitigation: Experiences And Reflections by Pardeep Sahni.
3. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning.

Reference Books:

1. Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978
2. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
3. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003
4. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo,1994
5. Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi, 2003

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7P1	**Building Information Modelling Laboratory**	0	0	3	3	50	50	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To understand BIM Basics & the Benefits.	5, 10, 11	3, 4
CO2	To describe how BIM can be used as a communication and collaboration tool, and its contributions to Scheduling, Estimating, and Facility Management.	5, 10, 11	3, 4
CO3	To explain the process of implementing BIM and how BIM-based designs for Structural, Mechanical, Electrical, Plumbing, Communications, Security, Fire Protection fit into the overall Construction Document fabric.	5, 10, 11	3, 4

Part – A:

Building Information Modelling: Introduction, Basic concepts, BIM part of the building design process, Evolution & development of BIM, Uses & benefits of BIM, BIM platforms, Building components, Building vocabulary, Specifications, Exploring the User Interface.

Part – B:

Construction

1. Creating floor plans using commands
2. Creating & modifying levels & grid, walls modelling, section details, creating & importing families of objects & elements, modifying objects & elements
3. Viewing the Building Model, Managing Views, Controlling Object Visibility, Working with Section and Elevation views, Creating and Modifying 3D Views.
4. Using Dimensions and constraints, working with Dimensions, Applying and Removing Constraints.
5. Developing the Building Model, Creating and Modifying Floors, Adding and Modifying Ceilings, Adding and Modifying Roofs, curtain walls, Stairs and Railings.
6. Detailing and Drafting, Creating Callout views, working with Text and Tags, Detail Views, Drafting Views.
7. Presenting the Building Model, Creating and Printing Drawing Sheets, Working with Title Blocks, Managing Revisions.
8. Adding & modifying materials & colours
9. Creating Renderings, Using Walkthroughs, Using Sun and Shadow Settings.
10. Importing layout plans from Auto CAD

Management:
1. Annotations & Documentation
2. Creating & Modifying Schedules
3. Construction Documentation
4. Creating Rooms & room schedules
5. Creating Legends & Keynotes
6. Cost estimation

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7P2	Navisworks Laboratory	0	0	3	3	50	50	100

Cos	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To know how to create and save simple and complex search sets.	5, 10, 11	3, 4
CO2	To know how to run clash tests based on search sets.	5, 10, 11	3, 4
CO3	To know about the process of saving clash templates.	5, 10, 11	3, 4
CO4	To know how to import clash templates to run various clash tests in variety of projects.	5, 10, 11	3, 4

List of Activities

1. Opening the Autodesk Navisworks Model and Changing the Workspace
2. Creating Search Sets
3. Performing Clash Tests
4. Exporting Clash Template and Saving the Current File
5. Importing Clash Template and Updating Clash Results
6. Model Development - User Interface & File Organization, Overriding transparency, color, and object model location.
7. Importing 3D Files, How to import and append 3D model File. Understanding Navis Works file formats, Object enablers

SEMESTER	Course Code	Course Title	L	T	P/S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7K1	Skill/Job Oriented Course-05	0	2	0	2	100	–	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain knowledge on any advanced courses related to CTM through MOOCs.	3,5,10	3,4

MOOC'S

The students must finish a certified course on any subject related to their particular domain/interdisciplinary/Industry through Swayam/NPTEL MOOCs providers and submit the certificate to the concerned instructor allotted by the department head.

Note:

1. Students can enrol any course from Swayam/NPTEL providers, during at the course duration and can submit the certificate at the end of VII semester.

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VII	CT21B7IN	Industrial / Research Internship	-	-	-	4	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain practical knowledge on the application of construction technology in the industry/research.	NA	NA

The student must submit and present a seminar report on the internship done

Pattern of Evaluation for Industrial/ Research – 100 Marks

1. Internship Report : 40 Marks
2. Presentation : 40 Marks
3. Internship certificate issued by the organization : 20 Marks

SEMESTER VIII

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VIII	CT21B8PT	Industrial Mini Project / Internship	-	-	-	12	100	-	100

COs	Course Outcomes	POs	BTLs
	The student will be able		
CO1	To gain practical knowledge on the application of construction technology in the industry.	8,10,12	NA

The student must submit and present a seminar report on the industry based mini project work done

Pattern of Evaluation for Practical Training – 100 Marks

- Project Report : 40 Marks
- Presentation : 40 Marks
- Training certificate issued by the organization : 20 Marks

SEMESTER	Course Code	Course Title	L	T	P/ S	C	Int. Marks	Ext. Marks	Total Marks
VIII	CT21B8PW	Project Work	-	-	-	18	100	100	200

COs	Course Outcomes	POs	BTLs
	The student will be able to		
CO1	To have a thorough review and outline various civil engineering problems that can be taken up as project work.	1,3,6,9	6
CO2	To work in a team to select a problem for project work.	1,3,6,9	6
CO3	To review and evaluate the available literature on the chosen problem.	1,3,6,9	6
CO4	To formulate a methodology to solve the identified problem With the help of faculty advisor.	1,3,6,9	6
CO5	To apply the principles, tools and techniques to solve the problem.	1,3,6,9	6
CO6	To prepare and present project report.	1,3,6,9	6

The evaluation will be done for 200 marks. 100 marks shall be for internal evaluation and 100 marks for the external evaluation at the end of the semester. External evaluation of the project (viva-voce) shall be conducted by a committee appointed by the Chief Superintendent of Examinations. The committee consists of an external examiner, Departmental Head, a senior faculty member and internal guide.

Division of marks for internal assessment – 100 marks

- Progress of Project work at the end of 10 weeks : 20 Marks
- Evaluation by the Guides (at the end of 15 weeks) : 20 Marks
- Project Report : 20 Marks
- Final presentation and defense of the project : 40 Marks

Pattern of External Evaluation for Project – 100 Marks

- Final Project Report : 25 Marks
- Presentation : 25 Marks
- Demonstration / Defense of Project : 50 Marks