

Course Curriculum
Second Year
B. Tech. in Civil Engineering
In line with National Education Policy 2020
(Effective from AY 2024-25 for University Department only)



Dr. Babasaheb Ambedkar Technological University
Lonere 402 103, Dist- Raigad, Maharashtra, INDIA

Established vide Maharashtra Act No. XXII of 1989 and Act. No. XXIX of 2014
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Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Second Year B. Tech. Civil Engineering

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester-III										
1	24UD1000BS301	Engineering Mathematics - III	3	0	0	20	20	60	100	3
2	24UD1191PC302	Mechanics of Solids	2	1	0	20	20	60	100	3
3	24UD1191PC303	Surveying	2	1	0	20	20	60	100	3
4	24UD1191PC304	Building Construction	3	0	0	20	20	60	100	3
5	24UD1ARPOEM05	Open Elective-I (From Bucket)	2	0	0	20	20	60	100	2
6	Refer Bucket	Multi-Disciplinary Minor-I (From Bucket)	3	0	0	20	20	60	100	3
7	24UD1000VE307	Constitution of India	0	0	0	-	-	-	AU	GR
8	24UD1000VE308	A. Life of Chhatrapati Shivaji Maharaj B. Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	0	0	50	0	0	50	1
10	24UD1191HM309	Entrepreneurship Development Process	1	0	0	50	-	50	100	1
11	24UD1191PCL310	Mechanics of Solid Lab	0	0	2	25	-	25	50	1
12	24UD1191PCL311	Surveying Lab	0	0	2	25	-	25	50	1
13	24UD1191MDL312	MDM-I Lab	0	0	2	25	-	25	50	1
TOTAL			17	2	6	295	120	485	900	22
Semester-IV										
1	24UD1191PC401	Structural Mechanics-I	2	1	0	20	20	60	100	3
2	24UD1191PC402	Concrete Technology	3	0	0	20	20	60	100	3
3	24UD1191PC403	Hydraulics Engineering	2	1	0	20	20	60	100	3
4	24UD1191PC404	Building Planning & Drawing	3	0	0	20	20	60	100	3
5	24UD1ARPOEM05	Open Elective-II (From Bucket)	3	0	0	20	20	60	100	3
6	24UD1UHVVE407	Universal Human Values-II	3	0	0	20	20	60	100	3
7	24UD1000VE408	A. Life of Chhatrapati Shivaji Maharaj B. Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	0	0	50	0	0	50	1
9	24UD1191PCL409	Concrete Technology Lab	0	0	2	25	-	25	50	1
10	24UD1000AE410	Modern Indian Language	2	0	0	20	20	60	100	2
11	24UD1191PCL411	Hydraulics Lab	0	0	2	25	-	25	50	1
12	24UD1191PCL412	Building Planning & Drawing Lab	0	0	2	25	-	25	50	1
13	24UD1ARPOEL413	Open Elective-II –Lab	0	0	2	25	-	25	50	1
TOTAL			19	2	68	290	140	520	950	25

Course Type	Course Code	Course Name	Course Type	Course Code	Course Name
Open Elective-I	24UD1ARPOEM05B	Building Materials & Composites	Multi-Disciplinary Minor-I	Refer Bucket	Refer Bucket
	24UD1ARPOEM05I	Design of Masonry Structures			
	24UD1ARPOEM05J	Energy Efficient Buildings	Modern Indian Language	24UD1000AE410A	Marathi
Open Elective-II	24UD1ARPOEM05G	Advanced Surveying		24UD1000AE410B	Hindi
	24UD1ARPOEM05H	Modern Surveying		24UD1000AE410C	Sanskrit

HONORS- CIVIL ENGINEERING

Sr.No.	Course Offered	Teaching Scheme (Hrs)				Credits
		L	T	P	TOTAL	
1	Finite Element Method	03	00	00	03	03
2	Limit State Design of Steel Structures	03	00	00	03	03
3	Elements of Remote Sensing	03	00	00	03	03
4	Building Planning and Design	03	00	00	03	03
5	Advanced Structural Design	03	00	00	03	03
6	Theory of Plates and Shells	03	00	00	03	03

RESEARCH - CIVIL ENGINEERING

Sr.No.	Course Offered	Teaching Scheme (Hrs)				Credits
		L	T	P	TOTAL	
1	Problem Identification and Definition	03	01	00	04	04
2	Experimental Work/Analytical Tools and Prototype Development	03	01	00	04	04
3	Literature Review	03	01	00	04	04
4	Publication	03	01	00	04	04
5	Data Analysis	03	01	00	04	04

MOOC/SWAYAM- COURSE

Sr.No.	Course Offered	Duration of Online Course
1	Urban Services Planning	06 to 12 weeks
2	Sustainable Building Planning	
3	Environmental Planning and Management	
4	Planning and Architectural Studies	

Teaching Scheme: Students must enroll any above mentioned course on online platform like MOOC/SWAYAM or can attend the offline workshops during the SEM-VII/VIII as per availability and produce the certificate to faculty co coordinator of institute/department. Assessment work can be done by faculty coordinator based on the students performance.

**MULTIDISCIPLINARY MINOR BASKET
UNIVERSITY DEPARTMENT**

**MINOR DEGREE IN CIVIL ENGINEERING
(for other than Civil Engineering program students)**

Semester	Subject Code	Subject Name	Total Credits
SEM-III	24UD1191MD306	Introduction to Engineering Geology	3
SEM-III	24UD1191MD306A	Building Construction	3
SEM-V	25UD1191MD506	Engineering Economics and Project Management	3
SEM-VI	25UD1191MD606	Town and Urban Planning	3
SEM-VII	25UD1191MD706	Geomatics Engineering	3
SEM-VII	25UD1191MD706A	Infrastructure Engineering	3
SEM-VIII	25UD1191MD801	MOOC/SWAYAM/NPTEL	2
MINIMUM CREDITS REQUIRED TO COMPLETE A MINOR DEGREE IN CIVIL ENGINEERING			14

**MINOR DEGREE IN PLANNING ENGINEERING
(only for Civil Engineering program students)**

Semester	Subject Code	Subject Name	Total Credits
SEM-III	24UD1191MD306	Introduction to Engineering Geology	3
SEM-III	24UD1191MDL312	Engineering Geology Lab	1
SEM-III	24UD1191MD306A	Site Planning	3
SEM-V	25UD1191MD506	Engineering Economics and Project Management	3
SEM-V	25UD1191MD506A	Planning Legislation	3
SEM- VI	25UD1191MD606	Town and Urban Planning	3
SEM-VI	25UD1191MD606A	Disaster Mitigation and Management	3
SEM-VII	26UD1191MD706A	Bamboo for Sustainable Development	3
SEM-VII	26UD1191MD706B	Ferrocement Technology	3
SEM-VIII	27UD1191MD801	MOOC/SWAYAM/NPTEL	2
MINIMUM CREDITS REQUIRED TO COMPLETE A MINOR DEGREE IN PLANNING ENGINEERING			14

Dr. Babasaheb Ambedkar Technological University, Lonere
Teaching & Evaluation Scheme for Second Year B. Tech. Civil Engineering

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			L	T	P	ISE	MSE	ESE	Total	
Semester-III										
1	24UD1000BS301	Engineering Mathematics - III	3	0	0	20	20	60	100	3
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3	24UD1191PC303	Surveying	2	1	0	20	20	60	100	3
4	24UD1191PC304	Building Construction	3	0	0	20	20	60	100	3
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7	24UD1000VE307	Constitution of India	0	0	0	-	-	-	AU	GR
8	24UD1000VE308	A. Life of Chhatrapati Shivaji Maharaj B. Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	0	0	50	0	0	50	1
10	24UD1191HM309	Entrepreneurship Development Process	1	0	0	50	-	50	100	1
11	24UD1191PCL310	Mechanics of Solid Lab	0	0	2	25	-	25	50	1
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13	24UD1191MDL312	MDM-I Lab	0	0	2	25	-	25	50	1
TOTAL			17	2	6	295	120	485	900	22

Course Type	Course Code	Course Name	Course Type	Course Code	Course Name
Open Elective-I	24UD1ARPOEM05B	Building Materials & Composites	Multi-Disciplinary Minor-I	Refer Bucket	Refer Bucket
	24UD1ARPOEM05I	Design of Masonry Structures			
	24UD1ARPOEM05J	Energy Efficient Buildings	Modern Indian Language	24UD1000AE410A	Marathi
Open Elective-II	24UD1ARPOEM05G	Advanced Surveying		24UD1000AE410B	Hindi
	24UD1ARPOEM05H	Modern Surveying		24UD1000AE410C	Sanskrit

Detailed Course Contents

SUBJECT CODE	<h2 style="margin: 0;">Civil Engineering Mathematics</h2>						CREDITS
24UD1000BS301							3
Teaching Work Load/week(Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	03	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Able to comprehend the fundamental knowledge of the Laplace and inverse Laplace transforms and their derivatives for elementary functions
CO2	Able to apply the properties of Laplace and inverse Laplace transforms to solve simultaneous linear and linear differential equations with constant coefficients
CO3	Able to conceptualize the definitions and properties of Fourier transforms, to solve boundary value problems using Fourier transforms
CO4	Able to find the solutions of partial differential equations governing real-world problems
CO5	Able to conceptualize limit, continuity, derivative and integration of complex functions, complex integrals useful in real-world problems

Course Contents

Module 1	Laplace Transform	Hrs. 9
Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n , scale change property, transforms of functions divided by t , transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.		
Module 2	Inverse Laplace Transform	Hrs. 9
Introductory remarks; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.		
Module 3	Fourier Transform	Hrs. 7
Definitions – integral transforms; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms; Parseval's identity for Fourier Transforms.		
Module 4	Partial Differential Equations and Their Applications	Hrs. 9
Formation of Partial differential equations by eliminating arbitrary constants and functions; heat Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional flow equation (i.e. $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$), and one dimensional wave equation (i.e. $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$).		
Module 5	Functions of Complex Variables	Hrs. 9
Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).		

Text Books:	
1	Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2	Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd.,
3	Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

Reference Books:	
1	Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
2	A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3	Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4	Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

SUBJECT CODE	Mechanics of Solids				CREDITS		
24UD1191PC302					3		
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	03	20	20	60	100

Pre-requisite: Engineering Mechanics

Course Objectives:	
COBJ 1	To understand concept of various types of stresses and strains.
COBJ 2	To study axial force, shear force, bending moment for determinate beams.
COBJ 3	To study concept of stresses in beam.
COBJ 4	To learn the concept of short and long columns.
COBJ 5	To familiarize students with the behavior of columns, shafts under torsion.

Course Outcomes: On completion of course, students will be able to	
CO1	Perform the stress-strain analysis.
CO2	Draw force, and bending moment distribution diagrams for determinate beams.
CO3	Determine stresses in beam, and distribution of stress for various cross sections.
CO4	Understand concept of Principal stresses and strains, and perform failure analysis.
CO5	Analyse columns, shafts, and stresses in thin-walled members.

Course Contents

Module 1	Stresses and Strains	Hrs. 08
<p>Stresses and strains: Analysis of internal forces, normal stress, shearing stress, bearing stress, statically indeterminate members. Stress-strain diagram for different engineering materials. Hooke's law: axial and shearing deformations, Poisson's ratio: biaxial and tri-axial state of stress, State of simple shear, Elastic constants and their inter-relation, introduction to strain measurement devices, Sensors: working principle.</p> <p>Concept of strain energy: Elastic, plastic and rigid members, stresses due to Gradually applied loads, suddenly applied loads, and Impact loads, Thermal stresses.</p>		

Module 2	Axial Force, Shear Force and Bending Moment	Hrs. 08
Axial force, shear force and bending moment in beams: concept of unbalanced forces and moments at a transverse section, axial forces, shear forces and bending moment diagram, relations among load shear and moment, introduction to moving loads.		
Module 3	Stresses in beams, and Direct and bending stresses	Hrs. 08
Simple bending: assumptions and derivation of flexural formula, economic sections, analysis of flexural action, moment of resistance, section modulus. Shearing stress: Derivation of formula, shear stress distribution for various cross sections, concept of shear flow, shear lag and shear center. Direct and bending stresses: Combined axial loads and bending moment, uniaxial & biaxial eccentric load, Kern of a section.		
Module 4	Combined stresses and strains, and Theories of failure	Hrs. 08
Combined stresses and strains: Analytical and graphical representation of state of combined stress at a point, absolute maximum shearing stress, principal stresses and strains, application of Mohr's circle. Theories of Failure: maximum principal stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear stress theory, maximum shear strain theory.		
Module 5	Columns & Struts, Torsion of shafts, and Thin-Walled Structures	Hrs. 08
Columns and Struts: Concept of short and long columns, formulae by Euler, Euler's Crippling load for different end conditions, limitations of Euler's formula, equivalent length, Rankine's formula and its applications Torsion: Assumptions, derivation of torsion formulae, torsion of circular shafts, power transmission, stresses and deformation in determinate solid/hollow homogeneous shafts. Thin cylinders and spheres: circumferential and longitudinal stresses		

Text Books:	
1	Singer F.L. and Pytle, 2011, "Strength of Materials", Harper Collins Publishers, 4 th Edition
2	Junnarkar S.B., 2014, "Mechanics of Structures", Charotar Publishers, Anand, 31 st edition,
3	Sadhu Singh, 1978, "Strength of Materials", Khanna Publishers, N. Dehli
4	Prasad I.B, 1988, "A text book of Strength of Materials", Khanna Publishers, N. Dehli
5	Timoshenko S.P. and Young D.H., 2002, "Elements of Strength of Materials", East West Press
6	Ramamrutham S., 2011, "Strength of Materials", Dhanpat Rai and Sons, Delhi
7	Ramamrutham S., and R. Narayanan 2020, "Theory of Structures", Dhanpat Rai and Sons
Reference Books:	
1	Beer F P., Jhonston E. R., John. T. D E wolf, 2017, "Mechanics of Materials" TMH
2	Popov E.P.,2015, "Introduction to Mechanics of Solids", Prentice-Hall, Second Edition 2005
3	Crandall S.H., Dahl N.C., & Lardner T.J., 1955, "An Introduction to Mechanics of Solids", Tata McGraw Hill, 2 nd Edi, 1978
4	Nash W., 2005, "Strength of Materials Schaum's outline series", McGraw Hill, fourth edition
5	Punmia B. C., 2018, "Mechanics of Materials" Laxmi Publications, revised edition, 2016
6	Subramanian R., 2016, "Strength of Materials" Oxford University Press, 2nd edition

SUBJECT CODE		<h1>Surveying</h1>					CREDITS	
24UD1191PC303							3	
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)				
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total	
3	0	0	03	20	20	60	100	

Course Objectives	
COBJ 1	Describe the function of surveying in civil engineering construction.
COBJ 2	Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements
COBJ 3	Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse.
COBJ 4	Operate a total station to measure distance, angles, and to calculate differences in elevation.

Course Outcomes: Students will be able to	
CO1	Demonstrate various methods of linear and angular measurements.
CO2	Analyse surveying data of different types.
CO3	Conduct field work and application of scientific methodology in handling field data
CO4	Apply various surveying techniques for civil engineering problems
CO5	To prepare a map or plan to represent an area on a horizontal plan

Course Contents

Module 1	Linear Measurements	Hrs. 6
Definition, principles of surveying, classification, fields and office work, scales, conventional signs. Survey instruments, their care and adjustment, ranging and chaining, offsetting, plotting chain survey data, errors in chain and tapes, corrections- length, slope, temperature, pull sag reciprocal ranging, setting perpendiculars, well-conditioned triangles, traversing, plotting, enlarging and reducing figures		
Module 2	Angular Measurements and Plane Table Survey	Hrs. 7
Prismatic compass, surveyor's compass, bearing systems and conversions, local attraction, magnetic declination, dip traversing, adjustment of errors Plane table instruments and accessories, merits and demerits, methods: radiation, intersection, resection, traversing		
Module 3	Levelling and Contouring	Hrs. 7
Level line - Horizontal line - Levels and Staves, Spirit level – Sensitiveness, Bench marks - and Plotting Temporary and permanent adjustments, Fly and Check leveling, Booking, reduction, Curvature Refraction – reciprocal leveling - Longitudinal and cross sections -plotting Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs. Planimeter-Types, Theory, concept of zero circle, Study of Digital Planimeter, Computation of Areas and Volumes		
Module 4	Theodolite Traversing	Hrs. 7

Theodolite - Vernier and micro-optic - Description and uses - temporary and permanent adjustments of vernier transit Angles: Horizontal - Vertical - Heights and Distances - Traversing - Closing error and distribution - Gales's table - Omitted measurements.		
Module 5	Engineering Survey	Hrs. 7
Reconnaissance, Preliminary and location surveys for engineering projects, Layout, Setting out works, Route Surveys for highways, railways and waterways, Mine Surveying - Instruments. Tunnels: correlation of underground and surface surveys, shafts.		

Text Books:	
1	Surveying and Levelling Vol. I and Vol. II by T. P. Kanetkar and S. V. Kulkarni, Pune Vidyarthi Griha Prakashan..
2	Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain, Laxmi Publications.
3	Plane Surveying & Higher Surveying by Dr A. M. Chandra, New age international publishers New Delhi
4	Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part2", Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:	
1	Duggal S. K. "Surveying Volume II", Tata McGraw-Hill Publishing Company Limited.
2	Subramaniam R., "Surveying & Levelling", Oxford University Press.
3	Clark D., 1944, "Plane and Geodetic Surveying", Vol. I & II, C.B.S. Pub. & Distri., N. Delhi,
4	Duggal S. K. "Surveying Volume I", Tata McGraw-Hill Publishing Company Limited.

SUBJECT CODE		<h1>Building Construction</h1>						CREDITS
24UD1191PC304								3
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)				
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total	
3	0	0	3	20	20	60	100	

Course Objectives	
COBJ 1	Learn masonry construction with reference to different building material - stone, brick etc.
COBJ 2	Learn construction details of all components of RCC frame structures.
COBJ 3	Learn means of communication – door, window, staircase, ramp.
COBJ 4	Learn types and construction details of roof in timber & steel.
COBJ 5	Learn Low-cost construction & pre cast construction techniques.

Course Outcomes: Students will be able to	
CO1	Understand & Draw construction details of load bearing structures.
CO2	Understand & Draw construction details of RCC frame structures.
CO3	Understand & Draw construction details of different types of means of communication.
CO4	Understand & Draw construction details of different types of Roofs.
CO5	Understand & Draw construction details of low-cost construction & pre cast construction.

Course Contents

Module 1	Masonry Construction	Hrs. 8
<p>Stone masonry: Setting of stone, joints, Random rubble, un-coursed rubble, coursed rubble & ashlar, General principles observed in stone Masonry.</p> <p>Brick masonry: General principles observed in Brick masonry, Bonds – English bond, Flemish Bond</p> <p>Composite Masonry: types, Partition walls in brick, concrete block, timber, glass & aluminum, autoclaved blocks, fly ash bricks.</p> <p>Spanning members in Masonry construction – a) Arch – Types, method of construction b) Lintels – steel, timber, stone, RCC.</p> <p>Foundation – Dewatering, Excavation for Foundation, soil bearing capacity, Timbering and Strutting, Foundation detail.</p>		
Module 2	Reinforced Cement Concrete	Hrs. 8
<p>Concrete & Reinforcement: Ingredients of concrete, mix design, Properties, tests, curing, Mixing, Reinforcement specification etc.</p> <p>Footing Types: Column Footing, Isolated and Combined Column Footing, Raft Foundation, Types of Pile foundation – bearing, friction, sheet, anchor, batter, fender, compaction.</p> <p>Column, Slab & Beam: Construction detail, Reinforcement, Slab (one way & two way), Type of beams – simply supported, continuous, cantilever.</p> <p>Formwork: Definition, Requirements, Materials used, Types and Removal of Formwork.</p>		
Module 3	Means of Communication	Hrs. 6
<p>Horizontal Communication: Doors –Components of Doors, Classification, Battened & ledged, Battened, ledged & braced, batten, ledged, braced & framed, framed & paneled, glazed, flush, revolving, sliding, collapsible, rolling .</p>		

<p>Windows: Component of windows, Types of Windows: fixed, pivoted, double hung, sliding, casement, glazed, louvered, metal, dormer, sky light, ventilators, bay window.</p> <p>Vertical Communication – a) Stair Case, Types – straight, dog legged, open newel, geometrical, Bifurcated, circular b) Construction detail -staircase in Timber, stone, RCC, steel, etc c) Designing staircase with given area & height.</p> <p>Vertical Communication - Lift, Elevator and Escalators, Guidelines of ramp for physically handicapped person, minimum size requirement, construction detail.</p>		
Module 4	Roofs & Floors	Hrs. 6
<p>Roofs – a) Types - Pitched, Flat, lean-to roof, coupled roof, Couple close roof, Collar roof, Scissor roof, Domes, Shells b) components of pitched roof – wall plate, rafter, purlin, batten etc. .</p> <p>Trusses – a) Timber – king post truss, queen post truss b) steel trusses (types, joints).</p> <p>Floors – Timber floor, Timber floors supported on rolled steel joist, Flag stone floors resting on steel joists, Jack arch floors, Ribbed floors, pre cast concrete floor.</p> <p>Roof covering – Thatch covering, Shingles, Manglore Tiles, Aesbestos cement sheets, galvanized corrugated iron sheet, slates.</p>		
Module 5	Pre-fabricated structures, Building Skin, Low-cost construction	Hrs. 6
<p>Pre-fabricated structure - Principles- advantages and disadvantages, types of prefabricate, standardization, basic, nominal and actual dimensions, tolerances, joints production, transportation and erection</p> <p>Building Skin – Curtain walls with transoms, mullions and infilling panels of various materials, Suspended Glazing, Composite panel cladding.</p> <p>Low-cost construction techniques – Rat trap bond, compressed stabilized earth blocks, Bamboo construction, hollow blocks, pre cast wall & roof panels.</p>		

Text Books:	
1	Ghose, D. N. Construction Materials Tata McGraw Hill, New Delhi, 2014 ISBN: 9780074516478
2	Rangwala, S. C. Engineering Materials Charator publisher, Ahemdabad, 2015.
3	S. P. Arora and Bindra, Building Construction, Dhanpat Rai Publication, Delhi Edition 2013.
4	S. C. Rangawala, Building Construction Charotar Publication, Dist-Anand.
5	Sushil Kumar, Building Construction, Standard Publication, Edition 2010.
6	Francis D. K. Ching, Building Construction

Reference Books:	
1	Dr. B.C. Punmia, Building construction Laxmi publications, 10th edition 2016.
2	A Text Book of Building Construction – S.P. Arora, S.P. Bindra (Dhanpat Rai Publications)
3	A to Z of Practical Building Construction and Its Management- Sandeep Mantri (Satya Prakashan, New Delhi)
4	Construction Technology (Volume 1 to 4) – R. Chudley (ELBS)
5	Engineering Materials – R.K. Rajput (S. Chand) • Handbook of Building Construction

SUBJECT CODE		OPEN ELECTIVE-I						CREDITS
24UD1ARPOEM05		B. Building Materials and Composites						02
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)				
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total	
2	0	0	02	20	20	60	100	

Course Objectives	
COBJ1	Learn materials required for masonry construction
COBJ2	Learn materials required for floor finishing work.
COBJ3	Study the materials for door, windows, reinforcement.
COBJ4	Learn the materials required for painting work.
COBJ5	Learn the smart construction materials

Course Outcomes: Students will be able to	
CO1	Understand building materials with their properties.
CO2	Understand selection of appropriate material.
CO3	Understand specifications of materials.
CO4	Understand the use of materials for painting.
CO5	Understand about smart construction materials.

Course Contents

Module 1	Stones & Bricks	Hrs. 5
Natural & Artificial materials used in construction, Properties of building materials -Physical properties Mechanical properties, Chemical properties, Electrical properties, Magnetic properties, Thermal properties. Stone: Classification of rocks, qualities of good building stones, Tests for stones, Dressing of stones, common building stones in India, Use of stone in construction. Brick: Ingredient of brick earth, manufacture of Brick, Quality of good brick, Tests for bricks, Classification of bricks, Standard size of brick, Use of brick		
Module 2	Diverse materials & Floor Finishes	Hrs. 6
Glass, Aluminum, Asbestos, Bitumen, Cork, Gypsum, Fly ash. Rubber, adhesives, Mangalore tiles, Terracotta, sound absorbent materials. Floor Finish – mud, murrum, Tiles, flag stone, cement concrete, Terrazzo, Mosaic, Asphalt, Fiber Reinforced Polymer.		
Module 3	Timber & Steel	Hrs. 5
Timber - Soft wood, hard wood, defects in timber, Qualities of good timber, preservation of timber, Seasoning of timber, Plywood. Steel – Manufacturing of steel, Use of steel, factors affecting physical properties of steel, market forms of steel, properties of mild steel, preventive measures for corrosion.		
Module 4	Paints, varnishes & distemper	Hrs. 4
Paints – Classification of an ideal paint, Ingredients of an oil borne paint, Types of paints – cement paint, emulsion paint, enamel paint, oil paint, process of painting. Varnish – classification of an ideal varnish, Ingredients of varnish, Types of varnish Distemper – Properties of distemper, Ingredients of distemper, process of distemping		

Module 5	Smart Construction Materials	Hrs. 4
Definition, Principles of Piezo-electricity, materials (Polymers and Ceramics), sensors (Piezo-electric sensor, strain gauge, shear sensor, in-plane and out of plane sensor, accelerometer), smart composites Electrostrictive Materials, Magnetostrictive materials, Magnetoelectric materials, Magnetorheological fluids, Electrorheological fluids, Shape Memory materials		

Text Books:	
1	Ghose, D. N. Construction Materials Tata McGraw Hill, New Delhi, 2014 ISBN: 9780074516478
2	Rangwala, S.C. Engineering Materials Charator publisher, Ahemdabad, 2015,
3	S. P. Arora and Bindra, Building Construction, Dhanpat Rai Publication, Delhi Edition 2013
4	Sushil Kumar, Building Construction, Standard Publication, Edition 2010, ISBN: 9788180141683,

Reference Books:	
1	Dr. B.C. Punmia, Building construction Laxmi publications, 10th edition 2016.
2	A Text Book of Building Construction – S.P. Arora, S.P. Bindra (Dhanpat Rai Publications)
3	Engineering Materials – R.K. Rajput (S. Chand) • Handbook of Building Construction

SUBJECT CODE		MDM -1 Engineering Geology				CREDITS	
24UD1191MD306						3	
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
COBJ1	To recognize and classify rock and soil materials to identify suitable construction materials or as a stable foundation.
COBJ2	To offer the essential geological knowledge necessary for the construction of various kinds of civil engineering structures.
COBJ3	To focus on the core activities of engineering geologists like site characterization and geologic hazard identification and mitigation.
COBJ4	To arrange, and carry out site investigation methods to extract the necessary characteristics for a variety of technical applications.
COBJ5	To interpret field and laboratory data for safety and security of mega structures like tunnels and dams

Course Outcomes: Students will be able to	
CO1	Learn mineralogical and petrological features that are significant in characterizing its competency as
CO2	Learn how different geological conditions influence the design parameters of Civil Engineering
CO3	Understand the earth's structure and deformation history before applying rock mechanics theory.
CO4	Understand the site selection criteria for designing civil engineering projects that are both safe and
CO5	Learn about the influence of geological conditions on dams and tunnels, and also provide related

Course Contents

Module 1	Introduction and Geomorphology	Hrs. 8
<p>Introduction and history of Engineering Geology and related branches, applications in Civil engineering.</p> <p>Interior of Earth, Plate tectonics, Earthquakes, seismic zones in India.</p> <p>Geomorphology: - basic principles and processes like denudation and types of weathering.</p> <p>Landform formation and types associated with river, wind, and sea, and their relevance to civil engineering.</p>		
Module 2	Mineralogy and Petrology	Hrs. 8
<p>Mineralogy: - Study of physical properties of minerals and study of common rock-forming minerals & clay minerals.</p> <p>Petrology: Definition, rock cycle. Civil engineering significance. Igneous rocks: Origin, classification, textures, related structures, and their importance. Sedimentary rocks: Formation, classification, textures and structures, and their importance. Metamorphic rocks: Agents and types of metamorphism, textures, and structures and their importance.</p>		
Module 3	Structural Geology and Groundwater	Hrs. 6
<p>Geological maps: - Geologic cross-section, Attitude of beds like outcrops, strike, and dip. Study of tectonic structures</p>		

like folds and faults their origin, classification, diverse effects, and case studies. Joints and unconformities their origin, types, and diverse effects case studies. Groundwater: Sources of groundwater, water table, zones of groundwater, porosity, and permeability.		
Module 4	Geological Investigations	Hrs. 6
Introduction, geological survey, steps in geological investigations. Exploratory drilling types and limitations, preservation of cores, core logging, core recovery, Rock Quality Designation (RQD). Engineering properties of rocks like density, unit weight, porosity, strength, and index properties. Geophysical investigation applications in Civil engineering methods like electrical resistivity method, gravity method.		
Module 5	Geology of Dams, Reservoirs, and Tunnels	Hrs. 8
Dams: - Influence of geological conditions on location, alignment, design, and type of a dam, geological considerations in site selection for dams, and site improvement techniques e.g. grouting. Tunneling: - Types of tunnels, tunneling in various conditions e.g. folded/faulted region, deccan trap or any other kind of rocks. Influence of geological conditions on tunneling and remedial measures like tunnel lining. Bridges: - Types of bridges, dependence of types of bridges on geological conditions and remedial measures.		

Text Books:	
1	Singh Prabin, 2009, "Engineering and General Geology", S. K. Katariya and sons, Delhi.
2	Mukerjee P. K., 2013, "A Text Book of Geology", World Press Pvt. Ltd., Calcutta.
3	Gokhale K.V.G.K. and Rao D. M., 1982, "Experiments in Engineering Geology", TMN, New-Delhi.
4	Gupte R. B., "A Text Book of Engineering Geology", Pune Vidyarthi Griha Prakashan, Pune.
5	Subinoy Gangopadhyay, 2013, "Engineering Geology", Oxford University Press.

Reference Books:	
1	G. W. Tyrrell, 1926, "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi .
2	Legget R. F., 1983 "Geology Handbook in Civil Engineering", McGraw-Hill, New York.
3	Krynine D. P. & Judd W. R., 2005, "Principles of Engineering Geology & Geo- technics", CBS Publishers & distri. New Delhi.
4	Billings M. P., 1942, "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.
5	A. Holmes, 1944, "Principles of Physical Geology", ELBS Chapman & Hall, London.

SUBJECT CODE		<h1>Constitution of India</h1>				CREDITS	
24UD1000VE307						AU	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	2	0	2	--	--	--	GR

Course Objectives	
COBJ1	To create awareness about the Constitution of India and the essential values that are incorporated in it, i.e. Fundamental Rights, Fundamental Duties, DPSPs, etc.
COBJ2	To learn, along with their development and mechanism, about the divisions of executive, legislative and judiciary
COBJ3	To learn the function of the seminal positions in the government, like Prime Minister, President and the Council of Ministers and the State Legislature.
COBJ4	To Know how the municipal office, panchayat office etc. work for development of the society.
COBJ5	To understand the significance and function of the Election Commission.

Course Outcomes: Students will be able to	
CO1	To know the importance and need of Constitution for a democratic government.
CO2	To follow the fundamental rights, duties and principles and become a good citizen.
CO3	To be aware and respect the seminal positions like Prime Minister, President, Chief Minister, Council of Ministers, Local Administration, etc.
CO4	To understand the function of Election Commission and importance of following it.
CO5	To understand the Importance of Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States, etc.

Course Contents

Module 1	Introduction	Hrs. 5
Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy		
Module 2	Union Government and its Administration	Hrs. 5
Structure of the Indian Union: Federalism, Centre- State, relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.		
Module 3	State Government and its Administration	Hrs. 4
Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions		
Module 4	Local Administration	Hrs. 5
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati Raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments),		

Village level: Role of Elected and Appointed officials, Importance of grass root democracy.		
Module 5	Election Commission	Hrs. 5
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.		

Text Books:	
1	Sastry, T. S. N., (2005). India and Human rights: Reflections, Concept Publishing Company India (P Ltd.)
2	Nirmal, C.J., (1999). Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

SUBJECT CODE		Life of Bharat Ratna Dr. Babasaheb Ambedkar				CREDITS	
24UD1000VE308B						01	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
1	0	0	1	50	--	--	50

Course Objectives:	
COBJ1	Analyze Dr. Ambedkar's role in shaping India's constitution and social justice movements
COBJ 2	Recognize the relevance of his principles in contemporary engineering and societal contexts.
COBJ 3	Develop critical thinking and problem-solving skills through case studies and discussions.

Course Outcomes: Students will be able to	
CO1	Explain Dr. Ambedkar's key contributions to the Constitution of India, establishment of human values and social reform.
CO2	Identify and analyze his leadership qualities and strategic thinking.
CO3	Evaluate the impact of his legacy on Maharashtra's culture, politics, and economy.

Course Contents

Module 1	Introduction	Hrs. 5
Introduction to the Socio-political Context of Dr. Babasaheb Ambedkar's Era - British Colonialism - Indian National Movement - Caste Hierarchy - Untouchability - Social Reform Movements - Role in the Indian freedom struggle.		
Module 2	The Contribution of Dr. Babasaheb Ambedkar	Hrs. 5
Contributions to the Constitution of India - Vision for Social Justice and Empowerment.		
Module 3	Legacy and Relevance Today	Hrs. 4
Dr. Ambedkar and Marxism: An Exploration of his Thoughts on Marxism - Common Ground with Marxism - Focus on Class Struggle - Caste vs Caste - Primacy of Caste in Indian Society - Economic Ideas and Policies.		

Text Books:	
1	Keer, Dhananjay. Dr.Babasaheb Ambedkar Life and Mission. Popular Prakashan. 1954.
2	Ambedkar, B. R. Annihilation of Caste. Fingerprint Publishing. 2023.
3	Ambedkar, B. R. Buddha or Karl Marx. Infinite Words. 2024.
4	Ambedkar, B. R. The Problem of Rupee: It's Origin and it's Solution. Sudhir Prakashan. 2021.

SUBJECT CODE		Entrepreneurship Development Process				CREDITS	
24UD1191HM309						2	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	2	0	2	50	-	50	100

Course Objectives:	
COBJ1	To know need and barriers in the field of Entrepreneurship.
COBJ2	To understand the concept and process of entrepreneurship & Entrepreneurial Value.
COBJ3	To appreciate and apply the innovation and process of innovation
COBJ4	To learn the process and skills of creation and management of entrepreneurial venture
COBJ5	To learn typology of Entrepreneurship.

Course Outcomes: Students will be able to	
CO1	To know need and barriers in the field of Entrepreneurship.
CO2	To understand the concept and process of entrepreneurship & Entrepreneurial Value.
CO3	To appreciate and apply the innovation and process of innovation
CO4	To learn the process and skills of creation and management of entrepreneurial venture
CO5	To learn typology of Entrepreneurship.

Course Contents

Module 1	Introduction to the field of Entrepreneurship	Hrs. 6
Understanding entrepreneurship- Need and Importance for entrepreneurship development Mc Clelands Theory of Entrepreneurial Motivation, Barriers to entrepreneurship, Qualities of a successful entrepreneur Entrepreneurial Leadership/Intrapreneurship		
Module 2	Entrepreneurial Value & Types	Hrs. 6
Concept, Functions, Need. Myths about Entrepreneurship, Process of Entrepreneurship, Types of Entrepreneurs. Competencies and Characteristics of good Entrepreneurs, Entrepreneurial Value: Values, Attitudes and Motivation. Mindset.		
Module 3	Innovation and entrepreneurship	Hrs. 6

<p>Innovation, definition and classification. The relationship of innovation and entrepreneurship, creation of competitive advantage based on innovation. Innovative models. Product, process, organizational and marketing innovation and their role in business development, Entrepreneurship- Innovation and Problem Solving. Market understanding, Creativity & Entrepreneurship, Sources of ideas, Techniques of generating new ideas Sources of innovation (push, pull, analogies), transfer of technology. Creative methods and approaches used in innovation management.</p>		
Module 4	Creating Entrepreneurial ventures	Hrs. 4
<p>Business plan/project planning/project Appraisal & feasibility study. Environment scanning, business opportunities, creation of a business plan, project appraisal & feasibility study. Institutional finance: Institutions supporting small business enterprises, Angel investors & venture capitalist. Entrepreneurial Training, Role of Entrepreneurship Development institutes.</p>		
Module 5	Typology of Entrepreneurship	Hrs. 2
<p>Family Business in India: types of Family Business, Improving family businesses, Succession planning. E-Commerce/ franchising: Types of e-commerce, types of franchising businesses.</p>		

Text Books:	
1	Entrepreneurship by Hisrich Robert D/ Peters Micheal New Delhi / Tata McGraw Hill /2002
2	Entrepreneurial Management by P.N. Singh / J. C. Saboo Dr. P. N. Singh Centre for HRD
3	Entrepreneurial Development by Colombo Plan, New Delhi, Tata McGraw Hill, 1998
4	T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013)
5	Entrepreneurial Development by Gupta C. B. New Delhi, Somaiya Publication, 1995

Reference Books:	
1	Entrepreneurship Small Scale Industries by G. S. Batra and R. C. Dangal, Deep & Deep Publications Pvt., Ltd.,
2	Development Banks and Entrepreneurship Promotion in India by P. K. Sharma, Mittal Publications
3	Entrepreneurial Development by Vasant Desai (3 Volumes) Himalayan Pub House
4	Kachru Upendra: India Land of a Billion Entrepreneurs, Pearson.
5	Cases in International Entrepreneurship by Hisrich R. D., Chicago, Liven, 1997

SUBJECT CODE		<h1>Mechanics of Solid Lab</h1>				CREDITS	
24UD1191PCL310						1	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	50	-	50	100

Course Outcomes: Students will be able to	
CO1	Evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens.
CO2	Determine the strength of coarse aggregates.
CO3	Find the compressive strength of concrete cubes and bricks.
CO4	Apply field procedures in basic types of surveys, as part of a surveying team.
CO5	Determine physical properties of given coarse aggregates, fine aggregates and cement samples.

Course Contents

Practical Work consists of performance of at least seven experiments from the list below (excluding the eleventh study) experiment: Detailed report is expected. Perform at least 08 experiments as per requirements.

Experiment No 1	Tension test on ferrous and non-ferrous alloys (mild steel / cast iron /aluminum etc.)
Experiment No 2	Compression test on mild steel, aluminum, concrete, and wood.
Experiment No 3	Shear test on mild steel and aluminum (single and double shear tests).
Experiment No 4	Torsion test on mild steel and cast iron solid bars and pipes.
Experiment No 5	Flexure test on timber and cast-iron beams.
Experiment No 6	Deflection test on mild steel and wooden beam specimens.
Experiment No 7	Graphical solution method for principal stress problems.
Experiment No 8	Impact test on mild steel, brass, Aluminum, and cast-iron specimens.
Experiment No 9	Experimental on thermal stresses.
Experiment No 10	Strain measurement involving strain gauges / rosette
Assignment	Involving computer programming for simple problems of stress, strain computations is to be submitted

SUBJECT CODE		<h1>Surveying Lab</h1>				CREDITS	
24UD1191PCL311						1	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	50	-	50	100

Course Outcomes: Students will be able to	
CO1	Use the theodolite along with chain/tape, compass on the field.
CO2	Apply geometric and trigonometric principles of basic surveying calculations.
CO3	Plan a survey, taking accurate measurements, field booking, and adjustment of errors.
CO4	Apply field procedures in basic types of surveys, as part of a surveying team.
CO5	Employ drawing techniques in the development of a topographic map.

Course Contents

Practical Work consists of performances among the list below and detailed reporting in form of field book, journal and drawing sheets. Perform each of the following practical work.

Perform each of the following practical work

Experiment No 1	Chain and compass Traverse Survey.
Experiment No 2	Study and use of dumpy level, auto level to determine elevation of various points.
Experiment No 3	Study of Theodolite.
Experiment No 4	Evaluation of constant of Planimeter, and use of Digital Planimeter for measurement of areas.
Experiment No 5	Study and use of Total Station.
Experiment No 6	Methods of plane table survey.

Among following any two shall be performed

Experiment No 1	Reciprocal Levelling.
Experiment No 2	Illustration of Permanent adjustment of Dumpy Level
Experiment No 3	Measurement of Horizontal Angle by Various Methods
Experiment No 4	Measurement of Magnetic Bearing and Vertical Angle by Theodolite

Among following two shall be performed

1) Road survey, 2) Radial Contouring, 3) Block Contouring, 4) Theodolite Traversing

SUBJECT CODE		<h1>Engineering Geology Lab</h1>				CREDITS	
24UD1191MDL312						1	
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	25	-	25	50

Course Objectives	
CO1	To recognize and classify rock and soil materials to identify suitable construction materials or as a stable foundation.
CO2	To offer the essential geological knowledge necessary for the construction of various kinds of civil engineering structures.
CO3	To focus on the core activities of engineering geologists like site characterization and geologic hazard identification and mitigation.
CO4	To arrange, and carry out site investigation methods to extract the necessary characteristics for a variety of technical applications.
CO5	To interpret field and laboratory data for safety and security of mega structures like tunnels and dams

Course Outcomes: Students will be able to	
CO1	Identify minerals and rocks as basic components of foundation and construction material.
CO2	Read and interpret geological maps to identify and solve various geological difficulties.
CO3	Identify structures present in the field by studying structural geological blocks.
CO4	Read and identify the lithologs to assess the sub-surface ground quality for construction of any Civil
CO5	Identify various geological structures in the field to avoid any mishaps.

Course Contents

Perform at least 06 to 08 experiments as per the requirements

Experiment No 1	Study of physical properties of minerals.
Experiment No 2	Megascopic study of rock forming minerals.
Experiment No 3	Megascopic study of Igneous rocks.
Experiment No 4	Megascopic study of Secondary rocks.
Experiment No 5	Megascopic study of Metamorphic rocks.
Experiment No 6	Cross-section preparation and interpretation of geological maps.
Experiment No 7	Study of structural geological models.
Experiment No 8	Preparation and interpretation of bore log /litholog data on graph paper.
Experiment No 9	Study visit to the places of engineering geological importance.

Dr. Babasaheb Ambedkar Technological University, Lonere
Teaching & Evaluation Scheme for Second Year B. Tech. Civil Engineering

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester-IV										
1	24UD1191PC401	Structural Mechanics-I	2	1	0	20	20	60	100	3
2	24UD1191PC402	Concrete Technology	3	0	0	20	20	60	100	3
3	24UD1191PC403	Hydraulics Engineering	2	1	0	20	20	60	100	3
4	24UD1191PC404	Building Planning & Drawing	3	0	0	20	20	60	100	3
5	24UD1ARPOEM05	Open Elective-II (From Bucket)	3	0	0	20	20	60	100	3
6	24UD1UHVVE407	Universal Human Values-II	3	0	0	20	20	60	100	3
7	24UD1000VE408	A. Life of Chhatrapati Shivaji Maharaj B. Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	0	0	50	0	0	50	1
9	24UD1191PCL409	Concrete Technology Lab	0	0	2	25	-	25	50	1
10	24UD1000AE410	Modern Indian Language	2	0	0	20	20	60	100	2
11	24UD1191PCL411	Hydraulics Lab	0	0	2	25	-	25	50	1
12	24UD1191PCL412	Building Planning & Drawing Lab	0	0	2	25	-	25	50	1
13	24UD1ARPOEL413	Open Elective-II –Lab	0	0	2	25	-	25	50	1
TOTAL			19	2	68	290	140	520	950	25

Course Type	Course Code	Course Name	Course Type	Course Code	Course Name
Open Elective-I	24UD1ARPOEM05B	Building Materials & Composites	Multi-Disciplinary Minor-I	Refer Bucket	Refer Bucket
	24UD1ARPOEM05I	Design of Masonry Structures			
	24UD1ARPOEM05J	Energy Efficient Buildings			
Open Elective-II	24UD1ARPOEM05G	Advanced Surveying	Modern Indian Language	24UD1000AE410A	Marathi
	24UD1ARPOEM05H	Modern Surveying		24UD1000AE410B	Hindi
				24UD1000AE410C	Sanskrit

SUBJECT CODE		Structural Mechanics– I						CREDITS
24UD1191PC401								3
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)				
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total	
3	0	0	3	20	20	60	100	

Course Objectives	
COBJ1	To learn various methods to estimate deflection of beams
COBJ2	To learn Energy methods to solve structural system.
COBJ3	To learn Compatibility methods to solve indeterminate structures
COBJ4	To learn Determination of Continuous and end support moments of indeterminate beams and frames
COBJ5	To learn slope deflection method for analysis of structures

Course Outcomes: Students will be able to	
CO1	Describe the concept of structural analysis, degree of indeterminacy.
CO2	Calculate slopes and deflection at various locations for different types of beams.
CO3	Identify determinate and indeterminate trusses and calculate forces in the members of trusses.
CO4	Perform the distribution of the moments the in continuous beam and frame.
CO5	Calculate the deformations in frames.

Course Contents

Module 1	Beam Deflections	Hrs. 6
Calculations of deflection for determinate beams by double integration, Macaulay's method, moment area method, conjugate beam method, deflection by method of superposition.		
Module 2	Energy Principles	Hrs. 6
Strain energy and strain energy density, strain energy in traction, shear, flexure and torsion - Castiglano's and Engessor's energy theorems, principle of virtual work, application of energy theorems for computing deflections in beams, Maxwell's reciprocal theorem, Williot Mohr diagrams.		
Module 3	Method of Consistent Deformation	Hrs. 8
Different structural systems, concept of analysis, basic assumptions, indeterminacy, choice of unknowns, Castiglano's theorem Indeterminate Beams: Analysis of indeterminate beams: Propped cantilever and fixed beams - fixed end moments and reactions for standard cases of loading – slopes and deflections in fixed beams.		
Module 4	Moment Distribution Method	Hrs. 8
Analysis of continuous beams propped cantilevers, continuous beams - theorem of three moments - analysis of continuous beams settlement effects, thermal effect, Shear Force and Bending Moment diagrams for continuous beams, portal frames with and without sway.		
Module 5	Slope Deflection Method	Hrs. 8
Analysis of continuous beams, analysis of rigid frames, frames without sway and with sway, settlement effects, introduction to difficulties in frames with sloping legs and gabled frames		

Text Books:	
1	Reddy C. S., “Basic Structural Analysis”, Tata McGraw Hill,3rd edition 2010
2	Wang C.K., “Statically Indeterminate Structures”, McGraw Hill
3	Vazirani V.N., Ratwani M.M and Duggal S.K., “Analysis of Structures - Vol. I”
4	Khurmi R.S., “Theory of Structures”, S Chand, Delhi
5	Punmia B.C., “Structural Analysis”, Laxmi Publications
Reference Books:	
1	Timoshenko and Young, “Theory of structures”, McGraw Hill
2	Norris C. H. and Wilbur J. B., “Elementary Structural Analysis”, McGraw Hill
3	Kinney J. S., “Indeterminate Structural Analysis”, Oxford and IBH
4	Hibbler R. C., “Structural Analysis”, Pearson Publications, 9th Edition
5	Schodek, “Structures”, Pearson Education, 7th edition
6	Ramamrutham S. and Narayanan R., “Theory of Structures” Dhanpat Rai Publishers, Delhi

SUBJECT CODE		<h1>Concrete Technology</h1>				CREDITS	
24UD1191PC402						3	
Teaching Work Load/week(Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	03	20	20	60	100

Course Objectives	
COBJ1	To Learn about different ingredients of concrete.
COBJ2	Understand the manufacturing of concrete
COBJ3	To Learn about use of concrete as per type of construction.
COBJ4	Understand behavior of concrete after casting.
COBJ5	To learn about increasing strength of concrete.

Course Outcomes: Students will be able to	
CO1	Understand the various types and properties of ingredients of concrete
CO2	Understand the fresh properties of fresh concrete.
CO3	Understand effect of admixtures on the behavior of the fresh and hardened concrete.
CO4	Understand the fresh properties of harden concrete.
CO5	Formulate concrete design mix for various grades of concrete.

Course Contents

Module 1	Ingredients of Concrete	Hrs. 6
<p>Cement-manufacturing process, physical properties, hydration of cement, hydration products, chemical compounds in cement, types of cement,</p> <p>Aggregates- classification of aggregates, physical properties, mechanical properties, fineness and gradation of aggregates using sieve analysis, tests on aggregates.</p> <p>Water-specifications of water to be used for concert, quality of water for use in concrete,</p>		
Module 2	Properties of Fresh Concrete	Hrs. 6
<p>Nominal mix concrete, types of batching, mixing, transportation, placing including pumping and compaction techniques, workability, factors affecting workability, methods of measuring workability, segregation and bleeding, setting time, curing of concrete, types of curing, temperature effects on fresh concrete.</p>		
Module 3	Properties of Harden Concrete	Hrs. 6
<p>Desired properties of concrete, strength, durability, characteristic strength, compressive, tensile and flexure strength of concrete, stress-strain relationship tests on concrete, modulus of elasticity, effect of w/c ratio and admixtures on strength, creep and shrinkage of concrete, durability of concrete: minimum & maximum cement content, strength & durability relationship, exposure to different conditions, factors contributing to cracks in concrete, sulphate attack, alkali aggregate reaction.</p>		
Module 4	Admixtures & Special concretes	Hrs. 6
<p>Admixtures -Role of admixture, classification and types of admixtures like accelerators, retarders, plasticizers, super plasticizers, mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag.</p> <p>Special concretes – Lightweight concrete and its types, self-compacting concrete, high density concrete, fiber reinforced concrete, High Strength Concrete, High Performance concrete, geo-polymer concrete and Ferrocement technique.</p>		
Module 5	Concrete Mix Design	Hrs. 6
<p>Factors Governing Mix Design, Methods of Mix Design. factors affecting the mix design, Methods of Expressing Proportions, Trial Mixes, Acceptance Criteria, Factors Causing Variations, Quality Measurement in Concrete Construction, Non-destructive Testing of Concrete-rebound hammer test, ultrasonic pulse velocity test.</p>		

Text Books:	
1	Gambhir M. L. “Concrete Technology”, Tata Mc-Graw Hill 2015 15th edition
2	Shetty M. S. “Concrete Technology”, S. Chand 2005
3	Krishnaswamy, “Concrete Technology”, DhanapatRai and Sons

Reference Books:	
1	Orchard, “Concrete Technology”, Applied Science Publishers
2	Neville A. M., “Concrete Technology”, Pearson Education
3	Neville A. M., “Properties of Concrete”, Pearson Education
4	Relevant Publications by Bureau of Indian Standards, New Delhi
5	IS:10262(2009), IS:456 (2009), IS 4926 (2003)

SUBJECT CODE		Hydraulics Engineering				CREDITS	
24UD1191PC403						3	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	03	20	20	60	100

Course Objectives	
COBJ1	To introduce and give explanation of fundamentals of Fluid Mechanics and give fundamental knowledge of fluid with its properties, behaviour, forces on various surfaces and stability of submerged and floating body.
COBJ2	To develop understanding about Kinematics of fluid flow and equation used for analysis of dynamic fluids.
COBJ3	To provide students with a comprehensive understanding of fluid dynamics
COBJ4	To introduce the importance of Compressibility effect in pipe flow.
COBJ5	To introduce the importance of fluid Flow in Pipes and determine the losses in a flow system.

Course Outcomes: Students will be able to	
CO1	Explain fundamental properties of fluids and calculate pressure.
CO2	Deeply understanding of fluid kinematics and dynamics.
CO3	Analyze laminar and turbulent flow characteristics, apply boundary layer theory, and understand the
CO4	Understand the concepts of dimensional analysis use the dimensionless number suitably.
CO5	Analyze head loss and energy loss in pipes, solve pipe network.

Course Contents

Module 1	Fluid Statics	Hrs. 6
Fluid properties and their role in fluid motion, concept of continuum, Types of fluids and their characteristics, Fluid Pressure – Pascal’s Law and its measurement, Hydrostatic pressure on plane and curved surfaces, Buoyancy- Centre of buoyancy, stability of submerged and floating bodies, metacentre, metacentric height and its determination.		
Module 2	Kinematics & Dynamics of Fluid Flow	Hrs. 8
Fluid Kinematics – Types of fluid flows, Continuity equation for one-, two- and three-dimensional flows, Velocity and Acceleration, Velocity potential and Stream function, Vortex flow, Concept of flow net.		
Fluid Dynamics – Equation of motion, Euler’s equation, Bernoulli’s equation and practical applications of Bernoulli’s		

equation: Venturi meter, Orifice meter and Pitot tube, Momentum Equation, Free and forced vortex flow, Radial flow, Concept of Navier-Stokes equation.		
Module 3	Laminar & Turbulent Flow	Hrs. 8
Laminar Flow – Laminar flow between parallel, stationary and moving plates, Flow through tube. Turbulent Flow – Shear stress in turbulent flow and turbulent velocity profiles in fully developed pipe flow, Velocity distribution and shear stress in turbulent flow, Prandtl mixing length theory, Nikuradse's experiment. Boundary Layer Theory – Concept of boundary layer theory, Thickness of boundary layer, Separation of boundary layer. Concept of Lift and Drag.		
Module 4	Dimensional Analysis	Hrs. 5
Dimensions of various physical quantities, Rayleigh's method, Buckingham π method, Model Similitude, Model scales, non-dimensional numbers and their significance, Distorted and undistorted models.		
Module 5	Flow through Pipes	Hrs. 9
Minor losses, Head loss due to friction – Darcy-Weisbach equation, H.G.L. and T.E.L., Loss of energy in pipes, Pipe discharging for a reservoir, Pipe connecting two reservoirs in series and parallel, Pipe network analysis by Hardy Cross method, Siphon, Power transmission, Water Hammer in pipes-rigid and elastic water column theory, Surge tanks-function and types, Introduction to Moody's chart, Nomograms and other pipe diagrams.		

Text Books:	
1	Hydraulics and Fluid Mechanics including Hydraulics Machines by Dr. P. N. Modi and Dr. S. M. Seth, Standard Book House. ISBN: 978-81-89401-26-9
2	A Textbook of Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal, Laxmi Publications.
3	Fluid Mechanics including Hydraulic Machines by A. K. Jain, Khanna Publishers
4	Introduction To Fluid Mechanics by Philip J. Pritchard, John Wiley & Sons, INC.
5	Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw-Hill Higher Education.
6	A Textbook of Hydraulics Engineering by N.H. Kulkarni, TECHSAR Publications.

Reference Books:	
1	Introduction to Fluid Mechanics & Fluid Machines by S. K. Som & G. Biswas, Tata McGraw-Hill.
2	Fluid Dynamics by V. L. Streeter, K. W. Bedford and E. B. Wylie, New York, McGraw-Hill.
3	Fluid Mechanics by K. L. Kumar, S. Chand publication.

SUBJECT CODE		<h1>Building Planning & Drawing</h1>						CREDITS
24UD1191PC404								3
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)				
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total	
3	0	0	3	20	20	60	100	

Course Objectives	
COBJ1	To understand basic principles of building planning with respect to orientation and climate.
COBJ2	To learn plumbing and electrical systems essential for building services.
COBJ3	To study ventilation, air conditioning, and thermal insulation techniques.
COBJ4	To understand fire safety norms and acoustical design requirements.
COBJ5	To introduce anthropometry and sustainable green building practices.

Course Outcomes: Students will be able to	
CO1	Apply planning principles for designing climate-responsive residential buildings.
CO2	Develop plumbing and electrical layouts using appropriate standards.
CO3	Analyze ventilation and thermal performance for building comfort.
CO4	Integrate fire safety and acoustic elements in building design.
CO5	Utilize anthropometry and green concepts for efficient, eco-friendly structures.

Course Contents

Module 1	Planning & Design	Hrs. 8
Principles of building planning, significance sun diagram, wind diagram, orientation, Design considerations for apartment, bungalow, row house & twin bungalow. Building Bye laws – open space, height & size of rooms & building, parking, garden, toilet etc., documents required for building permission.		
Module 2	Plumbing & electrification	Hrs. 8
Concept of plumbing & drainage plan, understanding details of drainage layout various types of traps, fittings, pipes, chambers, design of septic tank, Electrification - Lighting design with Lumen method, Lighting layout with furniture arrangement, wiring methods.		
Module 3	Ventilation & Thermal insulation	Hrs. 8
Definition, necessity of ventilation, functional requirements, various system & selection criteria Artificial ventilation - Air conditioning: Purpose, classification, principles, working. Thermal Insulation: General concept, Principles, Materials, Methods Computation of Heat loss & heat gain in Buildings		
Module 4	Fire resistant & Acoustics	Hrs. 6
Causes of fire, Rules & regulations for means of access, height, open space etc Fire zones, Fire loads, Fire resistance of various building materials. Firefighting equipment's – extinguishers, hydrants, sprinklers, wet riser, down comer etc Fire detection system, fire alarm system, Fire staircase, fire lift, fire door, Acoustics - Definition, Understanding concept of reverberation, Sabine's formula, absorption coefficient, Acoustical treatment for walls, roofs, floors etc,		

acoustical materials, Noise control		
Module 5	Anthropometry & Green Building	Hrs. 6
Anthropometry: Study of Human dimensions, space required for various simple activities, Circulation spaces. Green Building: green building rating systems, green building criteria, components, Green Building: Rain water harvesting, passive solar design, site selection & planning		

Text Books:	
1	Shah, Kale, Pataki, “Building Drawing”, Tata McGraw- Hill
2	Sane Y. S., “Building Design and Drawing”, Allied Book Stall, Pune
3	Jain V.K., “Handbook of Designing and Installation of Services in High Rise Building Complexes”, Khanna Publishers, N. Dehli,

Reference Books:	
1	Deodhar S.V., “Building Science and Planning”, Khanna Publishers, New Dehli.
2	SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi
3	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings
4	Jain A.K., “The Idea of Green Building” Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-256-4

SUBJECT CODE	OPEN ELECTIVE-II						CREDITS
24UD1ARPOEM05	G. Advanced Surveying						3
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives:	
COBJ1	To get introduced to modern advanced surveying techniques involved such as remote sensing, Total station, GPS, Photogrammetry etc.
COBJ2	To learn about errors in measurements and their adjustments in a traverse.
COBJ3	To understand the principles and workings of Electronic Distance Measurement.
COBJ4	To get an understanding preparation of the contour map and compute area.
COBJ5	Recognize modern developments in surveying and develop introductory Geographic Information System (GIS) skills.

Course Outcomes: Students will be able to	
CO1	Learn about the basic principles and area calculation methods by Tacheometric surveying methods.
CO2	Understand the basic principles and workings of Total Station.
CO3	Learn about the basic principles and workings of Electronic Distance Measuring (EDM).
CO4	Understand the basic principles of GPS, GIS, and Remote Sensing.
CO5	Learn about advanced surveying technologies.

Course Contents

Module 1	Geodetic Surveying & SBPS	Hrs. 6
Introduction, purpose, and principles of tacheometric surveying. Instruments used in Tacheometry, Methods of Tacheometry (Stadia & Tangential) Methods of determining constants of Tacheometer and related examples using all methods. Anallactic Lens, advantages & disadvantages.		
Module 2	Total Station	Hrs. 8
Introduction and basics of Total Station like working principle, integral parts. Types of Total Station and entire setup. Total Station survey system errors and avoiding techniques. Overview of the computerized survey data system.		
Module 3	Digital Theodolite and Electronic Distance Measuring (EDM)	Hrs. 6
Introduction, purpose, features, and principles of Digital Theodolite. Parts and use of one-second Micro Optic Theodolite. Electronic Distance Measuring (EDM) instrument, basic principles and applications of E.D.M. Components of E.D.M and their functions.		
Module 4	Remote Sensing & GIS for Surveying	Hrs. 8
Basic principles of Remote Sensing & Geographic Information Systems, applications, and limitations. Platforms of GIS work. concept and types of thematic layers in GIS. Concept and applications of geospatial data, types of spatial data, and available sources. Photogrammetric Surveying – Principle, Scale, Number of Photographs, Deduction of distance& height		
Module 5	Advanced Surveying Equipment	Hrs. 8
Introduction, advancements in surveying equipment. Ground-based Lidar technology for surveying, working, advantages and limitations. Global Positioning System: - Types i.e., Handheld and Differential Global Positioning System, advantages and disadvantages. Drone Surveying: Overview, applications, and limitations.		

Text Books:	
1	Surveying & Levelling, 2/E—Subramanian—Oxford University Press
2	Surveying: Vol. II. and III by Dr. B. C. Punmia : Laxmi Publication - New Delhi.
3	Surveying and Levelling Vol. II by T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
4	Satheesh Gopi, N. Madhu, R. Sathikumar “Advanced Surveying” Pearson Publications.
5	A. M. Chandra and S. K. Ghosh, “Remote sensing and Geographical Information System”, Narosa Publishing House.
6	Remote Sensing & GIS,2/E—Bhatta-- Oxford University Press
Reference Books:	
1	Principles of Geographical Information System—Burrough-- Oxford University Press
2	Surveying—M.D.Saikia—PHI Learning Pvt .Ltd.Delhi
3	Basak, N. N., “Surveying and Levelling” McGraw Hill Education (India) Pvt. Ltd., Noida.
4	Duggal, S. K., “Survey I and Survey II”, Tata McGraw Hill Education Pvt. Ltd., Noida.

SUBJECT CODE		Universal Human Values - II				CREDITS	
24UD1UHVVE407						3	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Understand about necessity of Value Education.
CO2	Learn about harmony among humans.
CO3	Learn about harmony in the society.
CO4	Learn about harmony in the nature.
CO5	Learn about holistic approach in profession.

Course Contents

Module 1	Introduction to Value Education	Hrs. 6
Understanding Value Education - Self-exploration as the Process for Value Education. Continuous Happiness and Prosperity – the Basic Human Aspirations. Right Understanding, Relationship and Physical Facility. Happiness and Prosperity – Current Scenario. Method to Fulfill the Basic Human Aspirations		
Module 2	Harmony in the Human Being	Hrs. 6
Understanding Human being as the Co-existence of the Self and the Body. Distinguishing between the Needs of the Self and the Body. The Body as an Instrument of the Self. Understanding Harmony in the Self Harmony of the Self with the Body. Programme to Ensure self-regulation and Health.		
Module 3	Harmony in the Family and Society	Hrs. 6
Harmony in the Family – the Basic Unit of Human Interaction. Values in Human-to-Human Relationship. ‘Trust’ – the Foundational Value in Relationship. ‘Respect’ – as the Right Evaluation. Understanding Harmony in the Society. Vision for the Universal Human Order.		
Module 4	Harmony in the Nature (Existence)	Hrs. 10
Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature. Realizing Existence as Co-existence at All Levels. The Holistic Perception of Harmony in Existence.		
Module 5	Implications of the Holistic Understanding – a Look at Professional Ethics	Hrs. 10
Natural Acceptance of Human Values. Definitiveness of (Ethical) Human Conduct. A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order. Competence in Professional Ethics. Holistic Technologies, Production Systems and Management Models-Typical Case Studies. Strategies for Transition towards Value-based Life and Profession.		

Text Books:	
1	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.
3	Arora K. R., "Soil Mechanics and Foundation Engineering", Standard publishers
4	Punima B. C., "Soil Mechanics and Foundation Engineering", Laxmi publication
5	Nayak N. V., "Foundation Design Manual", Dhanpat Rai and Sons
6	NPTEL Video Lectures of Geotechnical Engg of Prof Dr. D. N. Singh IIT Bombay https://www.youtube.com/playlist?list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r
Reference Books:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews
7	Economy of Permanence - J C Kumarappa
8	Bharat Mein Angreji Raj - PanditSunderlal
9	Rediscovering India - by Dharampal
10	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11	India Wins Freedom - Maulana Abdul Kalam Azad
12	Vivekananda - Romain Rolland (English)
13	Gandhi - Romain Rolland (English)

SUBJECT CODE		<h1>Life of Chhatrapati Shivaji Maharaj</h1>				CREDITS	
24UD1000VE408						01	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
1	0	0	1	50	--	--	50

Course Objectives:	
COBJ1	Analyze Chhatrapati Shivaji Maharaj's leadership qualities, strategic thinking, and management skills.
COBJ2	Develop critical thinking and problem-solving skills through case studies and discussions.
COBJ3	Recognize the relevance of the Chhatrapati's principles and values in modern times.

Course Outcomes: Students will be able to	
CO1	Explain Chhatrapati Shivaji Maharaj's military strategies, conquests, and establishment of the Maratha Empire.
CO2	Evaluate the Chhatrapati's leadership qualities, such as courage, vision, human values and adaptability.
CO3	Apply the Chhatrapati's principles, such as decentralization and social welfare, to modern engineering challenges.

Course Contents

Module 1	Shivaji Maharaj as a Great Conqueror	Hrs. 5
Master Strategist and innovator in Military Tactics, Guerrilla Warfare (Ganimi Kava), Fortress Strategy, Avoidance of Direct Confrontation, Diplomacy and Alliances, Naval Power.		
Module 2	Shivaji Maharaj's Management and leadership strategies	Hrs. 5
Architecture and metallurgy of Raigad Fort, Use of Light Cavalry, Intelligence Network, Asymmetric Warfare, Logistics and Supply Chains, Fortifications and Military Architecture.		
Module 3	Shivaji Maharaj's views on Democracy and Nationalism	Hrs. 4
Shivaji Maharaj's views about Women's rights, their dignity and religious views, His views on Democracy & Nationalism.		

Text Books:	
1	Desai, Ranjit. Shriman Yogi. Mehta Publishing House. 2018.
2	Kurundkar, Narhar. Chatrapati Shivaji Maharaj Jeevan Rahasya. Deshamukh and Company. 2024
3	Keluskar, Krushnaji Arjun. Chhatrapati Shivaji Maharaj. Sudhir Prakashan. 2020.
4	Bedekar, Ninad. Kalatil Vyavsthapan Tatve. 2015.
5	Sarkar, Jadunath. Shivaji and His Times by Jadunath Sarkar, Classic Book on the Life and History of the Maratha Emperor. Nandy Books. 2024.

SUBJECT CODE		<h1>Concrete Technology Lab</h1>				CREDITS	
24UD1191PCL409						1	
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	50	-	50	100

Course Outcomes: Students will be able to	
CO1	Analyze the properties of concrete and their verification.
CO2	Calculate different parameters for fresh concrete.
CO3	Understand properties of aggregates.
CO4	Design concrete mix.
CO5	Learn testing of concrete.

Course Contents

Practical Work consists of at least three performances from groups listed below and detailed reporting in form of journal.

Practical examination shall be based on above. Perform at least 10 to 12 experiments as per requirements

Experiment No.1	Testing of Cement: Consistency, Fineness, Setting Time, Specific Gravity
Experiment No.2	Soundness and Strength Test for Cement
Experiment No.3	Testing of Aggregates: Specific Gravity, Sieve Analysis, Bulking
Experiment No.4	Placement Tests on Concrete: Workability Tests: Slump, Compaction
Experiment No.5	Strength Tests on Concrete: Compression, Flexure, Split & Tensile Test
Experiment No.6	Effects of Admixture: Accelerator, Retarder, Super Plasticizer
Experiment No.7	Exercise and verification of Concrete Mix Design
Experiment No.8	Non-destructive Testing for Concrete
Use of computer programs such as MS Excel is desirable for post-processing of results.	

SUBJECT CODE		<h1>Hydraulics Lab</h1>				CREDITS	
24UD1000AE410						1	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	25	-	25	50

Course Outcomes: Students will be able to	
CO1	Verify the basic energy principles (Bernoulli's equation).
CO2	Utilize the basic measurement techniques of fluid flow in orifice / mouthpiece / venturi meter / orifice meter.
CO3	Analyze the properties of fluids and their verification.
CO4	Calculate friction factor and major & minor losses in pipes.
CO5	Analyze the properties of different types of valves and pipe fittings.

Course Contents

Practical Work consists of at least eight performances from list below and detailed reporting in form of journal.

Experiment No 1	Measurement of Viscosity of various fluids
Experiment No 2	Determination of metacentric height
Experiment No 3	Measurement of pressure Piezometer, manometers, Pressure gauges
Experiment No 4	Measurement of discharge
Experiment No 5	Verification of Bernoulli's Theorem
Experiment No 6	Calibration of an orifice / mouthpiece / venturi meter / orifice meter
Experiment No 7	Demonstration of working of different types of valves and pipe fittings
Experiment No 8	Determination of loss of head due to Pipe Fittings
Experiment No 9	Study of factors affecting coefficient of friction for pipe flow (for two different materials and two different diameters)
Use of computer programs such as MS Excel is desirable for post-processing of results.	

SUBJECT CODE		Building Planning & Drawing Lab				CREDITS	
24UD1191PCL411						1	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	50	-	50	100

Course Outcomes: Students will be able to	
CO1	To Draw plan, elevation & section of structure
CO2	To draw municipal drawing
CO3	To draw electrical layout
CO4	To draw drainage layout
CO5	To draw furniture layout

Course Contents

Term work shall consist of detailed report of in form of set of drawings mentioned below. In practice sessions, free-hand sketching in drawing book is expected.

1	Architectural drawing (Plan, section & elevation of a building) apartment, row house etc
2	Municipal drawing
3	Center line plan
4	Foundation plan
5	Furniture layout
6	Electrical / lighting layout
7	Drainage layout
8	Rain water Harvesting Drawing

SUBJECT CODE		OPEN ELECTIVE-2 –LAB (Advanced Surveying)						CREDITS
24UD1ARPOEL413								1
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)				
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total	
0	0	2	2	25	-	25	50	

Course Outcomes: Students will be able to	
CO1	Utilize total station for various ground surveys.
CO2	Know traversing with the help of Digital Theodolite.
CO3	Take geographical coordinates using GPS for area calculation.
CO4	Prepare digitized topographic maps for surveying large areas.
CO5	Prepare digital thematic maps like slope maps, aspect maps etc.

Course Contents

Experiment No.1	Tacheometry Survey: To Carry out the project for 3 to 4 stations for closed traverse on undulating/hills regions and prepare the drawing sheet.
Experiment No.2	Total Station Survey: - To carry out the project for a small traverse on the ground and drawing contour map.
Experiment No.3	Determination of height, remote elevation, and distance between inaccessible points using Total Station.
Experiment No.4	Digital Theodolite: - Use of Theodolite as a Tacheometer with staff held in vertical and fixed hair method (No derivation).
Experiment No.5	Electronic Distance Measurement Meter: - Working and measurement techniques.
Experiment No.6	Digitization of map/ toposheet using software like GIS software.
Experiment No.7	Creation of thematic maps of toposheet using GIS software.
Experiment No.8	Handheld GPS Survey: - Area mapping, calculation, and preparation of report (excel or doc or pdf format).