Course Curriculum

Second Year

B. Tech. in Civil Engineering

In line with National Education Policy 2020

(Effective from AY 2025-26 for Affiliated Institutes)

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
"Vidyavihar", P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra, India
Telephone and Fax.: 02140 - 275142
www.dbatu.ac.in

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	25AF1000BS301	Engineering Mathematics III	3	0	0	20	20	60	100	3
2	25AF 1191PC302	Mechanics of Solids	2	1	0	20	20	60	100	3
3	25AF1191PC303	Surveying	2	1	0	20	20	60	100	3
4	25AF1191PC304	Building Construction	3	0	0	20	20	60	100	3
5	25AF1ARPOE05	OPEN ELECTIVE-I	2	0	0	20	20	60	100	2
6	Refer Bucket	Multi-Disciplinary Minor-I	3	0	0	20	20	60	100	3
7	25AF1191VE307	Constitution of India	2	0	0	-	-	-	AU	GR
8	25AF1000VE308B	Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	0	0	50	-	-	50	1
9	25AF1191PCL309	Mechanics of Solid Lab	0	0	2	25	-	25	50	1
10	25AF1000AE310	Modern Indian Language	2	0	0	50	-	50	100	2
11	25AF1191PCL311	Surveying Lab	0	0	2	25	-	25	50	1
		TOTAL	**20**	**2**	**4**	**240**	**140**	**470**	**850**	**22**
Semester-IV										
1	25AF1191PC401	Structural Mechanics-I	2	1	0	20	20	60	100	3
2	25AF1191PC402	Concrete Technology	3	0	0	20	20	60	100	3
3	25AF1191PC403	Hydraulics Engineering	2	1	0	20	20	60	100	3
4	25AF1191PC404	Building Planning & Drawing	3	0	0	20	20	60	100	3
5	25AF1ARPOE05	OPEN ELECTIVE-II	3	0	0	20	20	60	100	3
6	Refer Bucket	Multi-Disciplinary Minor-II	2	0	0	20	20	60	100	2
7	25AF1UHVVE407	Universal Human Values-II	3	0	0	20	20	60	100	3
8	25AF1000VE408A	Life of Chhatrapati Shivaji Maharaj	1	0	0	50	0	0	50	1
9	25AF1191HM409	Entrepreneurship Development Process	1	0	0	25	-	25	50	1
10	25AF1191PCL410	Hydraulics Lab	0	0	2	25	-	25	50	1
11	25AF1191PCL411	Building Planning & Drawing Lab	0	0	2	25	-	25	50	1
12	25AF1191PCL412	Concrete Technology Lab	0	0	2	25	-	25	50	1
		TOTAL	**20**	**2**	**6**	**290**	**140**	**520**	**950**	**25**

Course Type	Course Code	Course Name
Open Elective-I	25AF1ARPOEM05H	Building Materials
	25AF1ARPOEM05I	Design of Masonry Structures
	25AF1ARPOEM05J	Energy Efficient Buildings
Open Elective-II	25AF1ARPOEM05G	Advanced Surveying
	25AF1ARPOEM05Q	Modern Surveying

Course Type	Course Code	Course Name
Multi-Disciplinary Minor-I		Refer Bucket
Multi-Disciplinary Minor-II		Refer Bucket
Modern Indian Language	25AF1000AE310A	Marathi
	25AF1000AE310B	Hindi
	25AF1000AE310C	Sanskrit

Type of course:

Basic Science: **BS**	Engineering Science: **ES**
Program Elective: **PE**	Program Core: **PC**
Modern Indian Language: **MIL**	Indian Knowledge System: **IK**
Value Education Course: **VEC**	Ability Enhancement Course: **AE**
Vocational and Skill Enhancement: **VS**	Audit Course: **AU**
Open Elective: **OE** (Other than particular program)	Co-curricular & Extracurricular Activities: **CC**
Humanities, Management, language and Commerce: **HM**	Multidisciplinary Courses: **MD**

LIST OF ELECTIVE / OPEN ELECTIVE/ MULTIDISCIPLINARY MINOR COURSES

Below listed courses will be offered as per student's requirement and availability of subject expert with the approval of the head of the institute/department.

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM

Sr.No.	Course Offered	Teaching Scheme (Hrs)				Credits
		L	T	P	TOTAL	
1	Building Materials	02	00	00	02	02
2	Design of Masonry Structures	02	00	00	02	02
3	Energy Efficient Buildings	02	00	00	02	02
4	Advanced Surveying	03	00	00	03	03
5	Modern Surveying	03	00	00	03	03
6	Geomatics Engineering	03	00	00	03	03
7	Ground Improvement Techniques	03	00	00	03	03
8	Sustainable Construction Methods	03	00	00	03	03

PROGRAM ELECTIVE COURSE

Sr.No.	Course Offered	Teaching Scheme (Hrs)				Credits
		L	T	P	TOTAL	
1	Hydraulics Structures	03	00	00	03	03
2	Irrigation Engineering	03	00	00	03	03
3	Water Quality Engineering	03	00	02	05	04
4	Water Supply Engineering	03	00	02	05	04
5	Environment Health and Safety	03	00	02	05	04
6	Highway & Railway Engineering	03	00	02	05	04
7	Intelligent Transportation Systems	03	00	02	05	04
8	Bridge &Tunnel Engineering	03	00	02	05	04
9	Pollution Control & Treatment	03	00	02	05	04
10	Waste Water Engineering	03	00	02	05	04
11	Industrial Waste water Management	03	00	02	05	04
12	Professional Practices	03	00	02	05	04
13	Construction Cost Analysis	03	00	02	05	04
14	Estimation and Costing	03	00	02	05	04

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	Advanced Structural Design	03	00	00	03	03
3	Legal aspects in Civil Engineering	03	00	00	03	03
4	Advanced Environmental Engineering	03	00	00	03	03
5	Multimodal Urban Transportation Systems	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

SELF STUDY COURSE(MOOC/SWAYAM)

Sr.No.	Course Offered	Duration of Online Course
1	Research Methodology	08 to 12 weeks
2	Problem Identification and Definition	
3	Literature Review	
4	Publication	
5	Data Analysis	

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 BUCKET
for AFFILIATED INSTITUTES
MINOR DEGREE IN CIVIL ENINGEERING
(For other than B.Tech. in Civil Engineering program students)

Semester	Subject Code	Subject Name	Total Credit
SEM-III	25AF1191MD306A	Building Construction	3
SEM-III	25AF1191MD306	Introduction to Engineering Geology	3
SEM-IV	25AF1191MD406	Concrete Technology	3
SEM-V	25AF1191MD506	Geomatics Engineering	3
SEM-VI	25AF1191MD606	Project Management	3
SEM-VII	25AF1191MD706	Construction Equipment and Site Safety Management	2
MINIMUM CREDITS REQUIRED TO COMPLETE A MINOR DEGREE IN CIVIL ENGINEERING			**14**

MINOR DEGREE IN PLANNING ENINGEERING
(only for B.Tech. Civil Engineering program students)

Semester	Subject Code	Subject Name	Total Credit
SEM-III	25AFMDPLAN306A	Site Planning	3
SEM-III	25AF1191MD306	Introduction to Engineering Geology	3
SEM-IV	25AFMDPLAN406A	Fundamentals of Urban Design	2
SEM-IV	25AFMDPLAN406B	Town and Urban Planning	2
SEM-V	25AFMDPLAN506A	Real Estate Development and Management	3
SEM-V	25AFMDPLAN506B	Planning Legislation	3
SEM-VI	25AFMDPLAN606A	Disaster Mitigation and Management	3
SEM- VI	25AFMDPLAN606B	Project Management	3
SEM-VII	25AFMDPLAN706A	Sustainable Building Planning	3
SEM-VII	25AFMDPLAN706B	Appropriate Building Technologies	3
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	
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3	25AF1191PC303	Surveying	2	1	0	20	20	60	100	3
4	25AF1191PC304	Building Construction	3	0	0	20	20	60	100	3
5	25AF1ARPOE05	OPEN ELECTIVE-I	2	0	0	20	20	60	100	2
6	Refer Bucket	Multi-Disciplinary Minor-I	3	0	0	20	20	60	100	3
7	25AF1191VE307	Constitution of India	2	0	0	-	-	-	AU	GR
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10	25AF1000AE310	Modern Indian Language	2	0	0	50	-	50	100	2
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		TOTAL	**20**	**2**	**4**	**240**	**140**	**470**	**850**	**22**

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Multi-Disciplinary Minor-II	Refer Bucket	Refer Bucket
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	25AF1000AE310B	Hindi
	25AF1000AE310C	Sanskrit

Type of course:

Basic Science: **BS**	Engineering Science: **ES**
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Detailed Course Contents

SUBJECT CODE	Engineering Mathematics-III						CREDITS
25AF1000BS301							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	To introduce the concept of Laplace transforms**.**
COBJ 2	To develop skills in applying inverse Laplace transforms**.**
COBJ 3	To provide a fundamental understanding of Fourier transforms**.**
COBJ 4	To familiarize students with partial differential equations (PDEs)**.**
COBJ 5	To introduce functions of complex variables.

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 $\left(\mathbf{i.e}\ \frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, 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
25AF1191PC302		3

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	1	0	3	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**

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.

Concept of strain energy: Elastic, plastic and rigid members, stresses due to Gradually applied loads, Suddenly applied loads, and Impact loads, Thermal stresses.

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, 4th Edition
2	Junnarkar S.B., 2014, "Mechanics of Structures", Charotor Publishers, Anand, 31st edition,
3	Khurmi R.S., 2018, "Strength of Material", S. Chand and Co., New Delhi
4	Sadhu Singh, 1978, "Strength of Materials", Khanna Publishers, N. Dehli
5	Prasad I.B, 1988, "A text book of Strength of Materials", Khanna Publishers, N. Dehli
6	Timoshenko S.P. and Young D.H., 2002, "Elements of Strength of Materials", East West Press
7	Ramamrutham S., 2011, "Strength of Materials", Dhanpat Rai and Sons, Delhi
8	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, 2nd 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	Surveying						CREDITS
25AF1191PC303							3
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	1	0	3	20	20	60	100

Course Objectives	
COBJ 1	To introduce the fundamental principles and methods of surveying**.**
COBJ 2	To develop competency in measuring horizontal and vertical angles**.**
COBJ 3	To enable students to carry out leveling operations and contour mapping**.**
COBJ 4	To train students in the application of theodolite for traversing and angular measurements**.**
COBJ 5	To familiarize students with surveying techniques used in engineering projects.

Course Outcomes: Students will be able to	
CO1	Demonstrate various methods of linear and angular measurements.
CO2	Analyze 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, Sprit 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	Subramanium R., “Surveying & Levelling”, Oxford University Press.
3	Clark D., 1944, “Plane and Geodetic Surveying", Vol. I & II, C.B.S. Pub. & Distri., N. Delhi, 6th edi.
4	Duggal S. K. “Surveying Volume I”, Tata McGraw-Hill Publishing Company Limited.

SUBJECT CODE	Building Construction	CREDITS
25AF1191PC304		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**

Stone masonry: Setting of stone, joints, Random rubble, un-coursed rubble, coursed rubble & ashlar, General principles observed in stone Masonry.

Brick masonry: General principles observed in Brick masonry, Bonds – English bond, Flemish Bond

Composite Masonry: types, Partition walls in brick, concrete block, timber, glass & aluminum, autoclaved blocks, fly ash bricks.

Spanning members in Masonry construction – a) Arch – Types, method of construction b) Lintels – steel, timber, stone, RCC.

Foundation – Dewatering, Excavation for Foundation, soil bearing capacity, Timbering and Strutting, Foundation detail.

Module 2	**Reinforced Cement Concrete**	**Hrs. 8**

Concrete & Reinforcement: Ingredients of concrete, mix design, Properties, tests, curing, Mixing, Reinforcement specification etc.

Footing Types: Column Footing, Isolated and Combined Column Footing, Raft Foundation, Types of Pile foundation – bearing, friction, sheet, anchor, batter, fender, compaction.

Column, Slab & Beam: Construction detail, Reinforcement, Slab (one way & two way), Type of beams – simply supported, continuous, cantilever.

Formwork: Definition, Requirements, Materials used, Types and Removal of Formwork.

Module 3	**Means of Communication**	**Hrs. 6**

Horizontal Communication: Doors –Components of Doors, Classification, Battened & ledged, Battened, ledged & braced, batten, ledged, braced & framed, framed & paneled, glazed, flush, revolving, sliding, collapsible, rolling.

Windows: Component of windows, Types of Windows: fixed, pivoted, double hung, sliding, casement, glazed, louvered, metal, dormer, sky light, ventilators, bay window.

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.

Vertical Communication - Lift, Elevator and Escalators, Guidelines of ramp for physically handicapped person, minimum size requirement, construction detail.

Module 4	**Roofs & Floors**	**Hrs. 6**

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, .

Trusses – a) Timber – king post truss, queen post truss b) steel trusses (types, joints).

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.

Roof covering – Thatch covering, Shingles, Manglore Tiles, Aesbestos cement sheets, galvanized corrugated iron sheet, slates.

Module 5	**Pre-fabricated structures, Building Skin, Low-cost construction**	**Hrs. 6**

Pre-fabricated structure - Principles- advantages and disadvantages, types of prefabricate, standardization, basic, nominal and actual dimensions, tolerances, joints production, transportation and erection

Building Skin – Curtain walls with transoms, mullions and infilling panels of various materials, Suspended Glazing, Composite panel cladding.

Low-cost construction techniques – Rat trap bond, compressed stabilized earth blocks, Bamboo construction, hollow blocks, pre cast wall & roof panels.

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.
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
25AF1ARPOEM05	H.Building Materials	2

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	20	20	60	100

Course Objectives	
COBJ 1	Learn materials required for masonry construction
COBJ 2	Learn materials required for floor finishing work.
COBJ 3	Study the materials for door, windows, reinforcement.
COBJ 4	Learn the materials required for painting work.
COBJ 5	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, Asphalt, 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 distempering.		
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 Electro strictive 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	OPEN ELECTIVE-I	CREDITS
25AF1ARPOEM05	I. Design of Masonry Structures	2

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	20	20	60	100

Course Objectives	
COBJ 1	Learn materials required for masonry construction
COBJ 2	Learn materials required for floor finishing work.
COBJ 3	Study the materials for door, windows, reinforcement.
COBJ 4	Learn the materials required for painting work.
COBJ 5	Learn the smart construction materials

Course Outcomes: Students will be able to	
CO1	Describe about masonry construction.
CO2	Assess the strength and stability of masonry walls.
CO3	Explain the design aspects of reinforced masonry.
CO4	Design a masonry wall.
CO5	Describe the behaviour of reinforced masonry & masonry walls in composite action.

Course Contents

Module 1	**Masonry Units, Materials, types and masonry construction**	**Hrs. 6**
Brick, stone and block masonry units – strength, modulus of elasticity and water absorption of masonry materials –classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks.		
Module 2	**Strength & Stability**	**Hrs. 6**
Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.		
Module 3	**Design Considerations**	**Hrs. 6**
Effective height of walls, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels.		
Module 4	**Design of masonry walls**	**Hrs. 4**
Estimation of load and load combinations, analysis and design of masonry and reinforced masonry members, Working and ultimate strength design, lateral load distribution in flexible and rigid diaphragm, infill walls, cyclic load, Capacity design spectra, codal provisions for seismic resistance, strengthening of existing masonry structures.		
Module 5	**Reinforced masonry & masonry walls in composite action**	**Hrs. 4**
Reinforced masonry and its application, flexural and compression elements of reinforced masonry, shear walls. Composite masonry walls, composite wall beam elements, infilled frames.		

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	Henry,A.W, "Structural masonry", Macmillan Education Ltd., 1990.
2	Dayarathnam.P, "Brick and reinforced brick structures", Oxford & IBH Publication, 1987.
3	Engineering Materials – R.K. Rajput (S. Chand) • Handbook of Building Construction.

SUBJECT CODE	OPEN ELECTIVE-I	CREDITS
25AF1ARPOEM05	J. Energy Efficient Buildings	2

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	20	20	60	100

Course Objectives	
COBJ 1	Ability to calculate the energy balance of buildings without the aid of available energy calculation programs
COBJ 2	Ability to assess for potential conflict between energy conservation and indoor climate for different energy-saving measures
COBJ 3	Ability to analyze and interpret results both critically and independently regarding energy and indoor climate in buildings based on values from both calculations and measurements
COBJ 4	Ability to demonstrate ability to work independently on investigating energy and indoor climate issues for buildings and present the results orally and in writing in well-prepared technical reports.
COBJ 5	Ability to calculate the energy balance of buildings without the aid of available energy calculation programs

Course Outcomes: Students will be able to	
CO1	Learn with climate responsive building design and basic concepts.
CO2	Will Know the basic terminologies related to buildings.
CO3	Will Know the passive (air) conditioning techniques.
CO4	Will be able to evaluate the performance of buildings.
CO5	Gets acquainted with Renewable energy systems in buildings.

Course Contents

Module 1	**Introduction**	**Hrs. 6**

Introduction to energy efficiency in buildings-Architecture- Building Science and its significance- Indoor Environment. Components of Indoor Environment - Classification of building materials based on energy intensity-Energy Management of Buildings and Energy Audit of Buildings.

Climate and Building, Historical perspective, Aspects of green building design – Sustainable Site, Water, Energy, Materials and IAQ, ECBC Standards.

Module 2	**Strength & Stability**	**Hrs. 6**

Energy efficient Landscape design – Microclimate, Shading, Arbors, Windbreaks, Xeriscaping, Building envelope – Thermal comfort, Psychrometry, Comfort indices, Thermal Properties of Building Materials – Thermal Resistance, Thermal Time Constant (TTC), Diurnal Heat Capacity (DHC), Thermal Lag, Decrement Factor, Effect of Solar Radiation – Sol-air Temperature, Processes of heat exchange of building with environment, Insulation. Building technology and building services engineering (HVAC) Contribution to lower energy consumption, with different conditions for new and existing buildings.

Module 3	**Passive heating and cooling**	**Hrs. 6**

HVAC introduction, Passive Heating – Solar radiation basics, Sun Path Diagram, Direct Heating, Indirect Heating and Isolated heating, Concept of Daylighting, Passive Cooling – Natural Ventilation (Stack and Wind), Evaporative Cooling and Radiative Cooling.

Module 4	Thermal performance of buildings	Hrs. 4
Heat transfer due to fenestration/infiltration, Calculation of Overall Thermal Transmittance, Estimation of building loads: Steady state method, network method, numerical method, correlations, Thermal Storage integration in buildings.		
Module 5	**Renewable energy in buildings**	**Hrs. 4**
Introduction of renewable sources in buildings, BIPV, Solar water heating, small wind turbines, standalone PV systems, Hybrid system – Economics.		

Text Books:	
1	ASHRAE Handbook -2009 – Fundamentals.
2	Baruch Givoni: Climate considerations in building and Urban Design, John Wiley & Sons, 1998
3	Baruch Givoni: Passive Low Energy Cooling of Buildings by, John Wiley & Sons, 15-Jul-1994
4	JA Duffie and WA Beckman: Solar Engineering of Thermal Processes, Third Edition, John Wiley & Sons.
5	Energy Performance Assessment for Equipment & Utility Systems (Book 4)
Reference Books:	
1	SodhaM.,Bansal N.K., Bansal,P.K Kumar, A. and Malik, M.A.S.,"SolarPassive Buildings", Pergamon Press, 1986.
2	Koenigsberger, O.H., Ingersoll, T.G., Mayhew Alan and Szokolay, S. V., "Manual of Tropical Housing and Building part 1: Climatic Design", OLBN 0 002120011, Orient Longman Limited, 1973.
3	Energy Efficiency in Thermal Utilities (Book 2)

SUBJECT CODE	Constitution of India						CREDITS
25AF1COIVE307							AU
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	--	--	--	GR

Course Objectives	
COBJ 1	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.
COBJ 2	To learn, along with their development and mechanism, about the divisions of executive, legislative and judiciary
COBJ 3	To learn the function of the seminal positions in the government, like Prime Minister, President and the Council of Ministers and the State Legislature.
COBJ 4	To Know how the municipal office, panchayat office etc. work for development of the society.
COBJ 5	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: Organization, 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, Panchayati Raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: 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	B.Life of Bharat Ratna Dr.Babasaheb Ambedkar	CREDITS
25AF1000VE308		1

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
COBJ2	Recognize the relevance of his principles in contemporary engineering and societal contexts.
COBJ3	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	Mechanics of Solid Lab	CREDITS
25AF1191PCL309		1

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	1	25	-	25	50

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. Preform 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	उपयोजित मराठी /व्यावहारिक मराठी अभ्यासक्रम	CREDITS
25AF1000AE310A		2

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	50	-	50	100

अभ्यासक्रमाची उद्दिष्टे:	
१	मराठी भाषेचा ऐतिहासिक प्रवास, तिच्या निर्मितीतील संस्कृत, प्राकृत आणि अपभ्रंश भाषांचा प्रभाव समजून घेणे.
२	मराठी लेखनाचे नियम, व्याकरण व शुद्धलेखन यांची अचूकता आत्मसात करणे.
३	सर्जनशील आणि औपचारिक लेखन कौशल्ये विकसित करणे.
४	भाषांतर तत्त्वे, प्रक्रिया आणि सांस्कृतिक संदर्भ यांचा विचार करून मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर करण्याचे कौशल्य प्राप्त करणे.

अभ्यासक्रमाचे परिणाम:: विद्यार्थी सक्षम असतील	
CO1	मराठी भाषेच्या ऐतिहासिक प्रवासाची समज वाढवतील आणि तिच्या विकासातील टप्पे स्पष्टपणे सांगू शकतील.
CO2	शुद्ध व प्रमाणबद्ध लेखन करण्याची क्षमता प्राप्त होईल.
CO3	विविध प्रकारच्या लेखन शैली आत्मसात करून सृजनशील, विश्लेषणात्मक आणि औपचारिक लेखन करू शकतील.
CO4	अचूक, स्पष्ट आणि भाषिक-सांस्कृतिक दृष्टिकोनातून योग्य भाषांतर करू शकतील. व्यावसायिक आणि साहित्यिक भाषांतरात प्रावीण्य मिळवू शकतील.

अभ्यासक्रम

घटक - १	**मराठीचा उगम आणि विकास**	**Hrs. 5**
मराठीचा उगम आणि विकास मराठी भाषेवर संत परंपरेचा प्रभाव - ज्ञानेश्वर, तुकाराम, नामदेव आणि एकनाथ यांच्या रचनांचा अभ्यास. मराठीत बखरी लेखन व इतिहासदर्शन. आधुनिक मराठी आणि सुधारणा चळवळी- टिळक,फुले, आणि आगरकर यांचे योगदान.		
घटक- २	**स्वातंत्र्यानंतरची मराठी भाषा**	**Hrs. 5**
महाराष्ट्र राज्य निर्मिती व मराठीचा अधिकृत दर्जा.डिजिटल युगातील मराठी भाषा: ब्लॉग, सोशल मीडिया आणि ई-साहित्य. मराठी भाषा संरक्षणासाठी उपाययोजना.शिक्षणव्यवस्थेतील मराठीचा वापर,जागतिक स्तरावर मराठी भाषेचा प्रभाव.		
घटक-३	**मराठी लेखनाचे नियम आणि व्याकरण**	**Hrs. 4**
संधि वाक्यप्रकार (विधानार्थी वाक्य, प्रश्नार्थी वाक्य, आज्ञार्थी वाक्य इ., विरामचिन्हे आणि त्यांचे उपयोग, शुद्धलेखन समानार्थी शब्द (पर्यायवाची शब्द), विरुद्धार्थी शब्द.		
घटक-४	**लेखन कौशल्य**	**Hrs. 5**
लेखन कौशल्याचा परिचय लेखन कौशल्याचे महत्त्व आणि आवश्यकता पत्रलेखन निबंध लेखन वृत्तलेखन (वृत्तपत्रीय लेखन) इतिवृत्त लेखन सारांश लेखन.		
घटक - ५	**भाषांतर (मराठीतून इंग्रजी अणि इंग्रजीतून मराठी)**	**Hrs. 5**
भाषांतराचा मूलभूत परिचय- भाषांतराची व्याख्या आणि स्वरूप, महत्त्व आणि उपयोग, भाषांतराचे प्रकार इ. पारिभाषिक शब्दावली मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर.		

संदर्भ साहित्य	
1	प्रशासनिक लेखन, भाषा संचालनालय, महाराष्ट्र शासन, मुंबई १९६६
2	सुगम मराठी व्याकरण व लेखन - मो.रा. वाळंबे
3	"अनुवाद सिद्धांत आणि प्रयोग" - डॉ.भालचंद्र नेमाडे
4	मराठी भाषा आणि साहित्याचा इतिहास – वि.का.राजवाडे प्रकाशक:राजवाडे संशोधन मंडळ, धुळे
5	भाषांतर:सिद्धांत आणि प्रयोग - डॉ. अशोक केळकर प्रकाशक :लोकवाय गृह, मुंबई

SUBJECT CODE	सामान्य हिंदी / व्यावहारिक हिंदी पाठ्यक्रम	CREDITS
25AF1000AE310B		2

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	50	-	50	100

पाठ्यक्रम के उद्देश्य:	
१	हिंदी भाषा के उद्भव,विकास और ऐतिहासिक प्रवृत्तियों को समझाना।
२	हिंदी व्याकरण और लेखन कौशल में दक्षता प्रदान करना।
३	प्रशासन, शिक्षा और संचार में हिंदी के व्यावहारिक उपयोग को स्पष्ट करना।
४	अनुवाद कौशल विकसित करना, जिससे तकनीकी एवं व्यावसायिक संचार सुगम हो।

पाठ्यक्रम के परिणाम: छात्र निम्नलिखित कार्य करने में सक्षम होंगे	
CO1	विद्यार्थी हिंदी भाषा के ऐतिहासिक औरआधुनिक विकास को समझेंगे।
CO2	हिंदी व्याकरण और लेखन के नियमों में दक्षता प्राप्त करेंगे।
CO3	व्यावसायिक, प्रशासनिक और तकनीकी लेखन में हिंदी का प्रयोग कर सकेंगे।
CO4	अनुवाद के सिद्धांतों को सीखकर अंग्रेजी और हिंदी के बीच प्रभावी अनुवाद कर सकेंगे।

पाठ्यक्रम

इकाई - १	**हिंदी भाषा का उद्भव और स्रोत**	**Hrs. 5**
हिंदी भाषा की उत्पत्ति औरस्वरूप संस्कृत, प्राकृत और अपभ्रंशसे हिंदीका विकास हिंदी की प्रमुख बोलियाँ (ब्रज, अवधी,खड़ी बोली,भोजपुरी,राजस्थानी आदि) हिंदी पर फारसी, अरबी और अंग्रेजी भाषाओं का प्रभा.		
घटक- २	**स्वातंत्र्योत्तर काल में हिंदी भाषा**	**Hrs. 5**
प्रशासन, शिक्षा और संचार माध्यमों में हिंदी की भूमिका राजभाषा के रूपमें हिंदी संवैधानिक स्थिति और व्यावहारिक उपयोग, हिंदी का वैश्विक विस्तार औरडिजिटल माध्यमों में हिंदी की उपस्थिति, प्रशासन और संचार माध्यमों में हिंदीI		
इकाई- ३	**हिंदी भाषा लेखन के नियम और व्याकरण**	**Hrs. 4**
वाक्य रचना वर्तनी उपसर्ग, प्रत्यय औरशब्द निर्माण की प्रक्रिया, विराम चिन्हों का प्रयोग,पर्यायवाची शब्द विलोम शब्द		
इकाई- ४	**लेखन कौशल**	**Hrs. 5**
पत्र लेखन, प्रतिवेदन (रिपोर्ट) लेखन विज्ञप्ति,नोटिस और परिपत्र लेखन, निवेध लेखन सार लेखन		
इकाई ५	**अनुवाद (अंग्रेजी से हिंदी और हिंदी से अंग्रेजी**	**Hrs. 5**
अनुवाद:सिद्धांत और परंपरा अनुवाद:क्षेत्र, प्रकार . पारिभाषिक शब्दावली • अंग्रेजीसेहिंदी औरहिंदी से आग्रेजी अनुवाद		

संदर्भ ग्रंथ:	
1	हिंदीभाषा का उद्भव और विकास डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
2	हिंदीभाषा का इतिहास डॉ.रामविलास शर्मा (राजकमल प्रकाशन)
3	हिंदीभाषा का इतिहास डॉ.रामविलास शर्मा (राजकमल प्रकाशन)
4	हिंदीव्याकरण और रचना डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
5	हिंदी लेखन कौशल डॉ.रमेशगुप्ता (साहित्य भवन)
6	"अनुवाद विज्ञान औरसिद्धांत डी. ओमप्रकाश (राजकमल प्रकाशन)

SUBJECT CODE	संस्कृत अभ्यासक्रम	CREDITS
25AF1000AE310C		2

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	50	-	50	100

Course Objectives:	
१	संस्कृत भाषेचा ऐतिहासिक प्रवास
२	संस्कृत लेखनाचे नियम, व्याकरण आत्मसात करणे.
३	दैनंदिन संवादासाठी लागणारे काही शब्द यांचा अभ्यास करणे.

Course Outcomes:	
CO1	विद्यार्थी संस्कृत भाषेच्या ऐतिहासिक प्रवासाची समज वाढवतील आणि तिच्या विकासातील टप्पे स्पष्टपणे सांगू शकतील.
CO2	शुद्ध व प्रमाणबद्ध लेखन करण्याची क्षमता प्राप्त होईल.
CO3	विविध प्रकारच्या लेखन शैली आत्मसात करून लेखन करू शकतील.
CO4	अचूक, स्पष्ट आणि भाषिक-सांस्कृतिक दृष्टिकोनातून योग्य भाषांतर करू शकतील.

Course Contents

Module-1	**Introduction to Sanskrit**	**Hrs. 7**
Importance and history of Sanskrit,Sanskrit alphabets (Varnamala),Swaras (Vowels)Vyanjanas Consonants), Pronunciation and script (Devanagari)		
Module-2	**Basic Grammar**	**Hrs. 5**
Nouns, pronouns, Grammatical numbers, Grammatical genders, Grammatical person,Verbs, Tenses, Sandhi (Combination of letters),Karaka (Case system) – Nominative, Accusative, Instrumental, etc.,Vibhakti (Declensions of nouns and pronouns),Linga (Gender: Masculine, Feminine, Neuter),Vakya Rachana (Sentence construction)		
Module-3	**Simple Vocabulary and Sentence Formation**	**Hrs. 5**
Basic words and their meanings (nature, family, animals, objects, etc.), Greetings and basic conversational phrases Formation of simple sentences.		
Module-4	**Selected Sanskrit Shlokas and Subhashitas**	**Hrs. 5**
Recitation and meaning of simple verses from Bhagavad Gita, Hitopadesha, or Panchatantra,Common proverbs (Subhashitas)		
Module-5	**Reading and Writing Practice**	**Hrs. 5**
Reading simple Sanskrit texts,Writing small paragraphs in Sanskrit		

Text Books:	
1	Siddhānta Kaumudī, Pandit Bhattoji Dikshita, Advanced grammar learners (Paninian system)
2	Laghu Siddhānta Kaumudī, Vaman Shivaram Apte, Intermediate Sanskrit grammar
3	Sanskrit Grammar, Whitney or Macdonell
4	A Higher Sanskrit Grammar, M. R. Kale,University-level students
5	Learn Sanskrit Through Self Study,N. Rajaram ,Beginners & self-learners
6	Samskrita Subhashitani, Samskrita Bharati Proverbs and sayings in Sanskrit

SUBJECT CODE	Surveying Lab						CREDITS
25AF1191PCL311							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	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

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	25AF1191PC401	Structural Mechanics-I	2	1	0	20	20	60	100	3
2	25AF1191PC402	Concrete Technology	3	0	0	20	20	60	100	3
3	25AF1191PC403	Hydraulics Engineering	2	1	0	20	20	60	100	3
4	25AF1191PC404	Building Planning & Drawing	3	0	0	20	20	60	100	3
5	25AF1ARPOE05	OPEN ELECTIVE-II	3	0	0	20	20	60	100	3
6	Refer Bucket	Multi-Disciplinary Minor-II	2	0	0	20	20	60	100	2
7	25AF1UHVVE407	Universal Human Values-II	3	0	0	20	20	60	100	3
8	25AF1000VE408A	Life of Chhatrapati Shivaji Maharaj	1	0	0	50	0	0	50	1
9	25AF1191HM409	Entrepreneurship Development Process	1	0	0	25	-	25	50	1
10	25AF1191PCL410	Hydraulics Lab	0	0	2	25	-	25	50	1
11	25AF1191PCL411	Building Planning & Drawing Lab	0	0	2	25	-	25	50	1
12	25AF1191PCL412	Concrete Technology Lab	0	0	2	25	-	25	50	1
		TOTAL	**20**	**2**	**6**	**290**	**140**	**520**	**950**	**25**

Course Type	Course Code	Course Name
Open Elective-I	25AF1ARPOEM05H	Building Materials
	25AF1ARPOEM05I	Design of Masonry Structures
	25AF1ARPOEM05J	Energy Efficient Buildings
Open Elective-II	25AF1ARPOEM05G	Advanced Surveying
	25AF1ARPOEM05Q	Modern Surveying

Course Type	Course Code	Course Name
Multi-Disciplinary Minor-I	Refer Bucket	Refer Bucket
Multi-Disciplinary Minor-II	Refer Bucket	Refer Bucket
Modern Indian Language	25AF1000AE310A	Marathi
	25AF1000AE310B	Hindi
	25AF1000AE310C	Sanskrit

Type of course:

Basic Science: **BS**	Engineering Science: **ES**
Program Elective: **PE**	Program Core: **PC**
Modern Indian Language: **MIL**	Indian Knowledge System: **IK**
Value Education Course: **VEC**	Ability Enhancement Course: **AE**
Vocational and Skill Enhancement: **VS**	Audit Course: **AU**
Open Elective: **OE** (Other than particular program)	Co-curricular & Extracurricular Activities: **CC**
Multidisciplinary Courses: **MD**	Humanities, Management, language and Commerce: **HM**

SUBJECT CODE	Structural Mechanics– I	CREDITS
25AF1191PC401		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”, ISBN NO: 978-81-7409-140-8
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	Concrete Technology	CREDITS
25AF1191PC402		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 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**

Cement-manufacturing process, physical properties, hydration of cement, hydration products, chemical compounds in cement, types of cement,

Aggregates- classification of aggregates, physical properties, mechanical properties, fineness and gradation of aggregates using sieve analysis, tests on aggregates.

Water-specifications of water to be used for concert, quality of water for use in concrete,

Module 2	**Properties of Fresh Concrete**	**Hrs. 6**

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.

Module 3	**Properties of Harden Concrete**	**Hrs. 6**

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.

Module 4	**Admixtures &** Special **concretes**	**Hrs. 6**
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. 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.		
Module 5	**Concrete Mix Design**	**Hrs. 6**
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.		

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
25AF1191PC403		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 introduce and give explanation of fundamentals of Fluid Mechanics and give fundamental knowledge of fluid with its properties, behaviour, forces on various surfaces.
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-Weisbatch equation, H.G.L. and T.E.L., Loss of energy in pipes, Pipe discharging for a reservoir, Pipe connecting two reservoir 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. ISBN: 978-81-31808-15-3
3	Fluid Mechanics including Hydraulic Machines by A. K. Jain, Khanna Publishers. ISBN: 978-81-74091-94-9
4	Introduction To Fluid Mechanics by Philip J. Pritchard, John Wiley & Sons, INC. ISBN: 978-04-70547-55-7
5	Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw-Hill Higher Education. ISBN: 978-00-74603-69-7
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. ISBN: 978-00-71329-19-4
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	Building Planning & Drawing	CREDITS
25AF1191PC404		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
25AF1ARPOEM05G	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	Understand the principles and applications of tacheometric surveying and its field operations.
COBJ2	Learn fundamental concepts of field astronomy for determining geographic coordinates.
COBJ3	Comprehend the principles, techniques, and instruments used in photogrammetric surveying.
COBJ4	Gain insights into the basics of Remote Sensing and GIS and their integration with surveying.
COBJ5	Familiarize with modern and special surveying instruments and their practical applications.

Course Outcomes: Students will be able to	
CO1	Explain the working principles and methods of tacheometric surveying and perform related calculations.
CO2	Utilize astronomical observations to determine azimuth, latitude, and longitude.
CO3	Interpret aerial photographs, compute scales, errors, and plan aerial surveys.
CO4	Describe the concepts of remote sensing and GIS, and demonstrate the use of thematic layers and spatial data.
CO5	Identify and operate modern surveying instruments such as Total Station, EDM, and specialized compasses.

Course Contents

Module 1	**Tacheometric Surveying**	**Hrs. 6**
Introduction, purpose, principle & use of tacheometry, Instrument used & stadia hairs & Fixed hair methods of tacheometry, Tacheometry constant & Problems Anallatic lens theory, subtense bar, Field work in tacheometry. Reduction of readings, errors and precisions. Difference between Theodolite & Tacheometer		
Module 2	**Field Astronomy**	**Hrs. 6**
Introduction & Instruments & purpose, Astronomical terms, Time & conversion of time, Abbreviations, Determination of azimuth, Latitude and longitude & Examples of azimuth, Latitude and longitude.		
Module 3	**Photogrammetric Surveying**	**Hrs. 8**
Introduction, principle, uses Aerial camera, aerial photographs Definitions, scale of vertical and tilted photograph Ground coordinates, ground control, examples on scale, Displacements and errors, Examples on Displacement and errors, Procedure of aerial survey, Examples on flight planning, Photomaps and mosaics. Difference between Mosaic & Map, Stereoscopes, Parallax bar, Examples on Parallax bar		
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	Special Survey Instruments	Hrs. 8
Introduction, Electromagnetic Distance Measurement, Electronics Theodolite, Total station, Site square, PentaGraph, Autoset Level, Transit level, Special Compasses, Brunton Universal Pocket Transit, Mountain Compass Transit.		

Text Books:	
1	Duggal, S. K., Surveying Vol. I & II, Tata Mcgraw Hill, New Delhi
2	Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi
3	Punamia, B.C., Surveying Vol. I, II & III, Laxmi Publications.
4	Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune Vidhyarthi Gruh.
5	Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi.
6	Basak, N.N., Surveying and Levelling, Tata Mcgraw Hill, New Delhi.

Reference Books:	
1	Agor, R. Advanced Surveying, Khanna Publishers, New Delhi
2	Roy, S.K., Fundamentals of Surveying, Prentice Hall India, New Delhi.
3	Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi
4	Anji Reddy, M., Remote Sensing and Geographical Information Systems, B.S.Publicati
5	Anderson, James M and Mikhail, Edward M, “Surveying theory and practice”, Mc Graw Hill

SUBJECT CODE	OPEN ELECTIVE-II	CREDITS
25AF1ARPOEM05Q	Modern 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 Statin 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",
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.
5	Anderson, James M and Mikhail, Edward M, "Surveying theory and practice", Mc Graw Hill Education, Noida.

SUBJECT CODE	Universal Human Values - II	CREDITS
25AF1UHVVE407		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	Life of Chhatrapati Shivaji Maharaj	CREDITS
25AF1000VE408A		1

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	Entrepreneurship Development Process						CREDITS
25AF1191HM409							1
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
1	0	0	1	25	-	25	50

Course Objectives: 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**
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, Entrepreneur 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.		
Module 4	**Creating Entrepreneurial ventures**	**Hrs. 4**
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.		
Module 5	**Typology of Entrepreneurship**	**Hrs. 2**
Family Business in India: types of Family Business, Improving family businesses, Succession planning. E-Commerce/ franchising: Types of e –commerce, types of franchising businesses.		

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	Hydraulics Lab						CREDITS
25AF1191PCL410							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
25AF1191PCL411		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	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	Concrete Technology Lab	CREDITS
25AF1191PCL412		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	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. Preform minimum 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.	