

Course Curriculum

Second Year

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

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester-III										
1	25AF1000BS301	Civil Engineering Mathematics	3	0	0	20	20	60	100	3
2	25AF1922PC302	Mechanics of Solids	2	1	0	20	20	60	100	3
3	25AF1922PC303	Surveying	2	1	0	20	20	60	100	3
4	25AF1922PC304	Water Supply Engineering	3	0	0	20	20	60	100	3
5	25AF1ARPOEM05	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	25AF1COIVE307	Constitution of India	2	0	0	-	-	-	AU	GR
8	25AF1000VE308B	Life of Bharat Ratna Dr. Babasaheb Ambedkar	1	0	0	50	-	-	50	1
9	25AF1922PCL309	Mechanics of Solid Lab	0	0	2	25	-	25	50	1
10	25AF1000AE310	Modern Indian Language	2	0	0	50	-	50	100	2
11	25AF1922PCL311	Surveying Lab	0	0	2	25	-	25	50	1
TOTAL			20	2	4	240	140	470	850	22
Semester-IV										
1	25AF1922PC401	Structural Mechanics	2	1	0	20	20	60	100	3
2	25AF1922PC402	Waste Water Engineering	3	0	0	20	20	60	100	3
3	25AF1922PC403	Hydraulics Engineering	2	1	0	20	20	60	100	3
4	25AF1922PC404	Building Planning, Drawing & Construction	3	0	0	20	20	60	100	3
5	25AFARPOE405	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	25AF1922PCL409	Waste Water Engineering Lab	0	0	2	25	-	25	50	1
10	25AF1922PCL410	Hydraulics Lab	0	0	2	25	-	25	50	1
11	25AF1922PCL411	Building Planning, Drawing & Construction Lab	0	0	2	25	-	25	50	1
12	25AF1922HM412	Entrepreneurship Development Process	1	0	0	25	-	25	50	1
TOTAL			20	2	6	290	240	520	950	25

Course Type	Course Code	Course Name	Course Type	Course Code	Course Name
Open Elective-I	25AF1ARPOEM05K	Environmental Chemistry & Microbiology	Multi-Disciplinary Minor-I	Refer Bucket	Refer Bucket
	25AF1ARPOEM05L	Environmental Policies and Legislation	Multi-Disciplinary Minor-II	Refer Bucket	Refer Bucket
	25AF1ARPOEM05M	Environmental Impact Assessment	Modern Indian Language	25AF1000AE310A	Marathi
Open Elective-II	25AF1ARPOEM05G	Advanced Surveying		25AF1000AE310B	Hindi
	25AF1ARPOEM05K	Modern Surveying		25AF1000AE310C	Sanskrit

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 department.

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM

Sr.No.	Course Offered	Teaching Scheme (Hrs)				Credits
		L	T	P	TOTAL	
1	Environmental Chemistry and Microbiology	02	00	00	02	03
2	Environmental Policies and Legislation	02	00	00	02	03
3	Environmental Impact Assessment	02	00	00	02	03
4	Advanced Surveying	03	00	00	03	03
5	Modern Surveying	03	00	00	03	03
6	Material Testing and Evaluation	03	00	00	03	03
7	Rehabilitation and Retrofitting of Structures	03	00	00	03	03
8	Sustainable construction materials	03	00	00	03	03

PROGRAM ELECTIVE COURSE

Sr.No.	Course Offered	Teaching Scheme (Hrs)				Credits
		L	T	P	TOTAL	
1	Water Quality Engineering	03	00	00	03	03
2	Pollution control and Treatment	03	00	00	03	03
3	Environment Health and Safety	03	00	00	03	03
4	Highway Engineering	03	00	00	03	03
5	Urban Transportation Planning	03	00	00	03	03
6	Tunneling & Underground Excavation	03	00	00	03	03
7	Geotechnical Engineering	03	00	00	03	03
8	Soil Mechanics and Foundation Engg	03	00	00	03	03
9	Advanced Environmental Engineering	03	00	00	03	03
10	Environmental Modeling & Simulation	03	00	00	03	03
11	Noise Pollution	03	00	00	03	03
12	Professional Practices	03	00	00	03	03
13	Construction Cost Analysis	03	00	00	03	03
14	Estimation and Costing	03	00	00	03	03

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	Elements of Remote Sensing	03	00	00	03	03
3	Advanced Structural Design	03	00	00	03	03
4	Theory of Plates and Shells	03	00	00	03	03
5	Structural Dynamics	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

Note: The elective courses listed in the Course Contents structure are indicative. Students shall ensure availability of Course Contents prior to registration.

SELF STUDY COURSE(MOOC/SWAYAM/NPTEL)

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 student's performance.

**MULTIDISCIPLINARY MINOR BUCKET
for AFFILIATED INSTITUTES
MULTIDISCIPLINARY MINOR BUCKET
for AFFILIATED INSTITUTES
MINOR DEGREE IN CIVIL & ENVIRONMENTAL ENGINEERING
(For other than B.Tech. in Civil & Environmental Engineering program students)**

Semester	Subject Code	Subject Name	Total Credit
SEM-III	25AF1922MD306	Introduction to Engineering Geology	3
SEM-III	25AF1922MD306A	Water Supply Engineering	3
SEM-IV	25AF1922MD406	Waste Water Engineering	3
SEM-V	25AF1922MD506	Concrete Technology	3
SEM-VI	25AF1922MD606	Project Management	3
SEM-VII	25AF1922MD706	Construction Equipment and Site Safety Management	2
MINIMUM CREDITS REQUIRED TO COMPLETE A MINOR DEGREE IN CIVIL ENGINEERING			14

**MINOR DEGREE IN PLANNING ENGINEERING
(only for B.Tech. in Civil & Environmental Engineering program students)**

Semester	Subject Code	Subject Name	Total Credit
SEM-III	25AFMDPLAN306A	Site Planning	3
SEM-III	25AF1922MD306	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

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Civil & Environmental Engineering

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2	25AF1922PC302	Mechanics of Solids	2	1	0	20	20	60	100	3
3	25AF1922PC303	Surveying	2	1	0	20	20	60	100	3
4	25AF1922PC304	Water Supply Engineering	3	0	0	20	20	60	100	3
5	25AF1ARPOEM05	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	25AF1COIVE307	Constitution of India	2	0	0	-	-	-	AU	GR
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TOTAL			20	2	4	240	140	470	850	22

Course Type	Course Code	Course Name	Course Type	Course Code	Course Name
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	25AF1ARPOEM05L	Environmental Policies and Legislation	Multi-Disciplinary Minor-II	Refer Bucket	Refer Bucket
	25AF1ARPOEM05M	Environmental Impact Assessment	Modern Indian Language	25AF1000AE310A	Marathi
25AF1ARPOEM05G	Advanced Surveying	25AF1000AE310B		Hindi	
25AF1ARPOEM05K	Modern Surveying	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

Detailed Course Contents

SUBJECT CODE	<h2 style="margin: 0;">Civil Engineering Mathematics</h2>				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: On completion of course, 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		<h1>Mechanics of Solids</h1>						CREDITS
25AF1922PC302								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, 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
<p>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.</p>		
Module 3	Stresses in beams, and Direct and bending stresses	Hrs. 08
<p>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.</p>		

Module 4	Combined stresses and strains, and Theories of failure	Hrs. 08
<p>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.</p> <p>Theories of Failure: maximum principal stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear stress theory, maximum shear strain theory.</p>		
Module 5	Columns & Struts, Torsion of shafts, and Thin-Walled Structures	Hrs. 08
<p>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</p> <p>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</p>		

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	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, 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	
25AF1922PC303						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: On completion of course, 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, 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, 6th edi.
4	Duggal S. K. “Surveying Volume I”, Tata McGraw-Hill Publishing Company Limited.

SUBJECT CODE		CREDITS
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25AF1922PC304		Water Supply Engineering				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 understand the environmental significance of water, its sources, and assess water demand and quality as per standards.
COBJ 2	To study the methods of collection and conveyance of raw water including design aspects.
COBJ 3	To learn various water treatment processes.
COBJ 4	To understand disinfection techniques and water softening methods for potable water quality.
COBJ 5	To explore different water supply systems, distribution networks, and their components.

Course Outcomes: On completion of course, students will be able to	
CO1	Understand the different sources of water.
CO2	Study different types of water treatment operations.
CO3	Study various parameters of water.
CO4	Apply appropriate disinfection and water softening techniques based on water quality and treatment goals.
CO5	Design and maintain efficient water distribution systems, including pipe networks, storage structures, and appurtenances.

Course Contents

Module 1	Introduction, quantity and quality of Water	Hrs. 08
Environment and its components, importance of water, role of environmental engineer, sources of water, water demand: Design flow, design period, design population, factors affecting water consumption, variation in demand, and design capacity for water supply components, quality of water: Physical, chemical, biological characteristics, Indian standard for quality of potable water		
Module 2	Collection and conveyance of water	Hrs. 05
Conveyance of raw water: Canals and pipelines, hydraulics of conduits, laying and jointing of pipelines, testing of pipe lines, designing of rising main, type of valves, types of pumps, intake structure, types of intake structures		
Module 3	Treatment of water	Hrs. 10
Necessity of water treatment processes Types of Treatments: Aeration: Necessity, methods, removal of taste and odour, design of aeration fountain Sedimentation: Suspended Solids, settling velocity, types of sedimentation tanks, surface loading, detention time, inlet and outlet arrangements Coagulation: Necessity, coagulant dosage, choice of coagulants, optimum pH Rapid Mixing: Necessity, gravitational, mechanical, pneumatic devices Slow Mixing and Flocculation: Design of flocculation chamber, mean velocity gradient, design of clari-flocculator, plate settler and tube settler Filtration: Theory of filtration, filter materials, types of filters, components, working and cleaning of filters		
Module 4	Disinfection	Hrs. 07
Theory of disinfection, factors affecting, efficiency of disinfection, types of disinfectants, break point chlorination,		

bleaching powder estimation Water softening methods: Lime-soda, ion exchange method, demineralization .		
Module 5	System of Water Supply	Hrs. 06
Gravitational, pumping and combined schemes, materials of water supply pipes, house connection from mains, different valves, meters and hydrants, storage reservoirs, balancing reservoir, detection and prevention of leaks in the distribution systems, maintenance of distribution systems.		

Text Books:	
1	Garg S. K., “Water Supply Engineering”, Khanna Publishers, New Delhi
2	Birdi J. S. and Birdi G. S., “Water Supply & Sanitary Engineering”, Dhanpat Rai Pub. Company, 8th edition, New Delhi
3	Dr. B.C. Punmia, Ashok Jain, Arun Jain “ Water Supply Engineering” Laxmi Publications
4	Howard S. Peavy, Donald R. Rowe, George Tchobanoglous “Environmental Engineering”, McGraw Hill Publications
Reference Books:	
1	Peavy and Rowe, “Environmental Engineering”, McGraw Hill Publications
2	Government Of India Publication, “Water Supply and Treatment Manual
3	Warren Viessman Jr., Mark J. Hammer, Elizabeth M. Perez, Paul A. Chadik “Water Supply and Pollution Control”, Pearson Education
4	Mackenzie L. Davis “Water and Wastewater Engineering”, McGraw-Hill Education

SUBJECT CODE	OPEN ELECTIVE-I	CREDITS
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25AF1ARPOEM05		K.Environmental Chemistry and Microbiology				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	To introduce the fundamental principles of chemistry relevant to environmental processes.
COBJ 2	To understand the chemistry, behaviour, and environmental impact of various organic and inorganic compounds.
COBJ 3	To familiarize students with key optical and chromatographic methods used for environmental analysis and pollutant detection.
COBJ 4	To provide an overview of environmental microbiology.
COBJ 5	To develop practical knowledge of microscopy, microbial enumeration, and the role of applied microbiology in soil, air, water, and wastewater treatment.

Course Outcomes: On completion of course, On completion of course, students will be able to	
CO1	Explain basic principles of environmental chemistry, including physical, organic, and colloid chemistry, and their relevance to environmental processes.
CO2	Analyze the environmental impact of organic and inorganic compounds such as hydrocarbons, surfactants, and pesticides, and understand their degradation pathways.
CO3	Apply principles of optical and chromatographic methods for qualitative and quantitative environmental analysis.
CO4	Describe the structure and function of microbial cells, metabolic reactions, and classify microorganisms relevant to environmental microbiology.
CO5	Demonstrate skills in microscopy, microbial enumeration, culturing techniques, and understand microbial roles in soil, air, water, and wastewater treatment.

Course Contents

Module 1	Fundamentals of Chemistry for Environmental Engineering:	Hrs. 04
Introduction, Basic Concepts from General Chemistry, Physical Chemistry, Equilibrium Chemistry, Organic, Biochemistry, Colloid Chemistry and Nuclear Chemistry.		
Module 2	Chemistry of Various Organic and Inorganic Compounds:	Hrs. 06
Carcinogenic compounds and their effects. Hydrocarbons: Chemistry of hydrocarbon decay, environmental effects, effects on macro and microorganisms. Surfactants: Cationic, anionic and nonionic detergents, modified detergents. Pesticides: Classification, degradation, analysis, pollution due to pesticides and DDT problems.		
Module 3	Optical Methods:	Hrs. 04
Principles of Optical Methods such as Absorption, Spectrophotometer, Flame photometry, Fluorometry. Principles of Chromatographic Methods such as Gas chromatography, High Performance Liquid Chromatography and Ion Chromatography.		
Module 4	Environmental Microbiology:	Hrs. 04
Scope and Areas of Environmental Microbiology, Cell and its Structure, Introduction to Enzyme and Metabolic Reactions, Aerobic and anaerobic respiration, Classification.		
Module 5	Microscopy and Micrometry:	Hrs. 06

Observations, Measurements and Isolation of Microorganism, Different Cultures, Media and Techniques of Staining and Enumeration of microorganism.

Applied Microbiology: of Soil, Air, Water and Biological Processes of Wastewater Treatments, Industrial Microbiology.

Text Books:

1	A.K. De “Environmental Chemistry”, New Age International Publishers
2	B.K. Sharma “Environmental Chemistry”, Goel Publishing House
3	S.S. Dara & D.D. Mishra “A Textbook of Environmental Chemistry and Pollution Control”, S. Chand Publishing
4	C.P. Baveja “A Textbook of Microbiology”, Arya Publications

Reference Books:

1	C.N. Sawyer, P.L. McCarty and G. F. Parkin, Chemistry for Environmental Engineering and Science, Tata McGraw-Hill, Fifth edition, New Delhi, 2003.
2	G.W. Vanloon and S.J. Duffy ‘Environmental chemistry – a global perspective, Oxford University press, New York., 2000
3	Tortora. G.J, B.R. Furke, and C.L. Case, “Microbiology-An Introduction” (4th Ed.), Benjamin/Cummings Publ. Co., Inc., California, 1992.
4	Benefield L. D., Judkins J.F. and Weaned R.L., Process Chemistry for Water and Wastewater Treatment, Prentice Hall, Inc. London, 1987.

SUBJECT CODE	OPEN ELECTIVE-I	CREDITS
25AF1ARPOEM05	L. Environmental Policies and Legislation	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	
COBJ 1	To introduce with Indian constitutional provisions and international environmental agreements
COBJ 2	To familiarize with the key provisions, regulatory framework, and compliance requirements of the Water (Prevention & Control of Pollution) Act, 1974.
COBJ 3	To develop an understanding of the Air (Prevention & Control of Pollution) Act, 1981, including the responsibilities of regulatory agencies and occupiers.
COBJ 4	To explore the Environment (Protection) Act, 1986 and associated rules related to EIA, waste management, and the roles of central and local authorities.
COBJ 5	To provide legal awareness of supporting environmental laws such as the Indian Forest Act, Public Liability Insurance Act, and important judicial interventions including PILs and landmark Supreme Court judgments.

Course Outcomes: On completion of course, students will be able to	
CO1	Explain the constitutional provisions, environmental policies, and international agreements that shape environmental governance in India.
CO2	Interpret the key features of the Water (Prevention and Control of Pollution) Act, 1974
CO3	Describe the framework and enforcement provisions under the Air (Prevention and Control of Pollution) Act, 1981,
CO4	Analyze the Environment (Protection) Act, 1986, with respect to delegated powers, EIA, waste management rules, and the responsibilities of various stakeholders.
CO5	Recognize the significance of supplementary environmental laws and judicial mechanisms,

Course Contents

Module 1	Introduction:	Hrs. 06
Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration – Environmental Protection Act, Water (P&CP) Act, Air (P&CP) Act – Institutional framework (SPCB/CPCB/MoEF).		
Module 2	Water (P & CP) Act, 1974:	Hrs. 06
WATER (P&CP) ACT, 1974 8 Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.		
Module 3	Air (P & CP) Act, 1981:	Hrs. 08
Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.		

Module 4	Environment (Protection) Act 1986:	Hrs. 10
Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards		
Module 5	Public Legislature:	Hrs. 06
Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC -Public Interest Litigation - Writ petitions - Supreme Court Judgments in Landmark cases		

Text Books:	
1	P. Leelakrishnan, “Environmental Law”, LexisNexis / Eastern Book Company
2	Shyam Divan and Armin Rosencranz, “Environmental Law and Policy in India”, Oxford University Press
3	S.C. Shastri, “Environmental Laws”, Eastern Book Company
4	K.R. Gupta, “Environmental Policy and Law” , Atlantic Publishers
Reference Books:	
1	Philippe Sands, Jacqueline Peel, Adriana Fabra, Ruth Mackenzie, “Principles of International Environmental Law”, Cambridge University Press
2	Nancy K. Kubasek & Gary S. Silverman, “ Environmental Law”, Pearson
3	David Hunter, James Salzman, Durwood Zaelke, “International Environmental Law and Policy”, Foundation Press / West Academic
4	Michael Kraft, “Environmental Policy and Politics”, Routledge / Taylor & Francis

SUBJECT CODE		OPEN ELECTIVE-I				CREDITS	
25AF1ARPOEM05		M. Environmental impact assessment				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
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Course Objectives	
COBJ 1	To introduce the need, structure, and legal framework of Environmental Impact Assessment (EIA) in India and globally.
COBJ 2	To develop an understanding of key environmental, social, and health-related issues considered in the EIA process
COBJ 3	To explore various EIA methodologies for identifying, measuring, and predicting environmental impacts.
COBJ 4	To analyze Environmental Management Plans (EMP), monitoring processes, and the significance of mitigation measures.
COBJ 5	To apply EIA concepts through case studies on real-world developmental projects across different sectors.

Course Outcomes: On completion of course, students will be able to	
CO1	Explain the purpose, legal framework, and procedural steps involved in Environmental Impact Assessment,
CO2	Identify key environmental issues and project-specific impacts, including land use, emissions, ecological and socio-economic factors,
CO3	Apply appropriate EIA methodologies such as checklists, matrices, and network analysis for predicting and interpreting environmental impacts.
CO4	Evaluate Environmental Management Plans (EMP) and design monitoring strategies for mitigation and compliance assessment.
CO5	Prepare and analyze EIA reports for various developmental projects using real-life case studies from sectors

Course Contents

Module 1	Introduction	Hrs. 6
The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, international agreements.		
Module 2	Identifying the Key Issues	Hrs. 06
Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection - Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio Economic Impacts, Ecological Impacts, Global Environmental Issues.		
Module 3	EIA Methodologies	Hrs. 08
Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. Reviewing the EIA Report Scope, Baseline Conditions, Site and Process alternatives, Public hearing, Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of		

Environmental Media Quality, Socio economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System		
Module 4	Review of EMP and Monitoring	Hrs. 8
Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, What should be monitored? Monitoring Methods, Who should monitor? Pre-Appraisal and Appraisal.		
Module 5	Case Studies:	Hrs. 06
Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.		

Text Books:	
1	Wathern. P Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.
2	Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
3	Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
4	Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
Reference Books:	
1	Larry W. Canter, “Environmental Impact Assessment”, McGraw-Hill
2	Charles H. Eccleston, “Environmental Impact Assessment: A Guide to Best Professional Practices”, CRC Press / Taylor & Francis
3	John Glasson, Riki Therivel, Andrew Chadwick, “Introduction to Environmental Impact Assessment”, Routledge
4	Albert Gilpin / Judith Petts, “Handbook of Environmental Impact Assessment (2 Volumes)”, Blackwell Science / Wiley-Blackwell

SUBJECT CODE		Constitution of India				CREDITS	
25AF1COIVE307						AU	
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	2	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				Life of Bharat Ratna Dr.Babasaheb Ambedkar				CREDITS
25AF1000VE308B								
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: On completion of course, 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		<h1>Mechanics of Solid Lab</h1>				CREDITS	
25AF1922PCL309						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: On completion of course, 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		A. उपयोजित मराठी /व्यावहारिक मराठी अभ्यासक्रम				CREDITS	
25AF1000AE310						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 परिणामः 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

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 आणि 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 :लोकवायू गृह, मुंबई

SUBJECT CODE		B.सामान्य हिंदी / व्यावहारिक हिंदी पाठ्यक्रम				CREDITS	
25AF1000AE310						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 और आधुनिक 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 और स्वरूप 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 प्रभाव।		
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, <u>हिंदी</u> का वैश्विक विस्तार और डिजिटल माध्यमों में हिंदी की उपस्थिति, प्रशासन और संचार माध्यमों में हिंदी।		
इकाई- ३	हिंदी भाषा लेखन के नियम और व्याकरण	Hrs. 4
वाक्य रचना वर्तनी उपसर्ग, प्रत्यय और शब्द निर्माण की प्रक्रिया, विराम चिह्नों का प्रयोग, पर्यायवाची शब्द विलोम शब्द		
इकाई- ४	लेखन कौशल	Hrs. 5
पत्र लेखन, प्रतिवेदन (रिपोर्ट) लेखन विज्ञप्ति, नोटिस और परिपत्र लेखन, निवेदन लेखन सार लेखन		
इकाई ५	अनुवाद (अंग्रेजी से हिंदी और हिंदी से अंग्रेजी)	Hrs. 5
अनुवाद: सिद्धांत और परंपरा अनुवाद: क्षेत्र, प्रकार . पारिभाषिक शब्दावली • अंग्रेजी से हिंदी और हिंदी से अंग्रेजी 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	हिंदी व्याकरण और रचना डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
5	हिंदी लेखन कौशल डॉ. रमेशगुप्ता (साहित्य भवन)
6	"अनुवाद विज्ञान और सिद्धांत डी. ओमप्रकाश (राजकमल प्रकाशन)

SUBJECT CODE		C.संस्कृत अभ्यासक्रम				CREDITS	
25AF1000AE310						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	Sanskrita Subhashitani, Sanskrita Bharati Proverbs and sayings in Sanskrit

SUBJECT CODE		<h2 style="margin: 0;">Surveying Lab</h2>				CREDITS	
25AF1922PCL311						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: On completion of course, 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 & Environmental Engineering

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester-IV										

1	25AF1922PC401	Structural Mechanics	2	1	0	20	20	60	100	3
2	25AF1922PC402	Waste Water Engineering	3	0	0	20	20	60	100	3
3	25AF1922PC403	Hydraulics Engineering	2	1	0	20	20	60	100	3
4	25AF1922PC404	Building Planning, Drawing & Construction	3	0	0	20	20	60	100	3
5	25AFARPOE405	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	25AF1922PCL409	Waste Water Engineering Lab	0	0	2	25	-	25	50	1
10	25AF1922PCL410	Hydraulics Lab	0	0	2	25	-	25	50	1
11	25AF1922PCL411	Building Planning, Drawing & Construction Lab	0	0	2	25	-	25	50	1
12	25AF1922HM412	Entrepreneurship Development Process	1	0	0	25	-	25	50	1
TOTAL			20	2	6	290	240	520	950	25

Course Type	Course Code	Course Name	Course Type	Course Code	Course Name
Open Elective-I	25AF1ARPOEM05K	Environmental Chemistry & Microbiology	Multi-Disciplinary Minor-I	Refer Bucket	Refer Bucket
	25AF1ARPOEM05L	Environmental Policies and Legislative	Multi-Disciplinary Minor-II	Refer Bucket	Refer Bucket
	25AF1ARPOEM05M	Environmental Impact Assessment	Modern Indian Language	25AF1000AE310A	Marathi
Open Elective-II	25AF1ARPOEM05G	Advanced Surveying		25AF1000AE310B	Hindi
	25AF1ARPOEM05K	Modern Surveying		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		<h2>Structural Mechanics</h2>						CREDITS	
25AF1922PC401								3	
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)					
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total		
2	2	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: On completion of course, 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

SUBJECT CODE		Waste Water Engineering						CREDITS
25AF1922PC402								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 the characteristics, sources, and flow dynamics of wastewater and factors affecting sewer design and sewage pumping.

COBJ2	To gain knowledge of primary and secondary physical and biological treatment processes for wastewater.
COBJ3	To study anaerobic treatment methods and factors influencing their efficiency in wastewater management.
COBJ4	To learn the various sludge treatment processes including thickening, stabilization, and disposal techniques.
COBJ5	To comprehend wastewater disposal methods, disinfection needs, and environmental standards for safe effluent discharge.

Course Outcomes: On completion of course, students will be able to	
CO1	Identify and quantify wastewater components, estimate flow rates, and design basic sewer systems and pumping stations.
CO2	Analyze and apply physical unit operations and biological processes for primary and secondary treatment of wastewater.
CO3	Explain the principles and operational factors of anaerobic treatment systems such as UASB and septic tanks.
CO4	Design and evaluate sludge treatment processes including thickening, stabilization, and disposal methods.
CO5	Assess wastewater disposal techniques, model self-purification of water bodies, and apply effluent standards for environmental protection.

Course Contents

Module 1	Introduction, Quantity & Quality of Wastewater	Hrs. 8
Components of Wastewater Flows, Wastewater Sources & Flowrate, Variations in Flowrates & Strength, Characteristics of Wastewater, Quantity of Wastewater, Sewer Design Considerations- Minimum Size of Sewer, Limiting Velocities, Peak Factor Sewage Pumping, Location, Capacity, Pumping Station Design		
Module 2	Primary and Secondary Treatment of Waste water	Hrs.10
Physical Unit Operations- Screening, Grit Removal, Oil & Grease Removal, Primary Sedimentation, Secondary Treatment: Fundamentals of Biological Treatment, Microbial Metabolism, Bacterial Growth & Kinetics, Suspended & Attached Growth Processes, Activated Sludge Process & its Modifications, Trickling Filters, Aerated Lagoons, Oxidation Ditch		
Module 3	Anaerobic Treatment of Wastewater	Hrs. 6
Anaerobic Suspended & Attached Growth Processes, Factors affecting Anaerobic Processes, Anaerobic Lagoons, UASB, Septic Tank		
Module 4	Sludge Treatment	Hrs. 6
Solid Sources, Characteristics & Quantities, Sludge Pumping, Treatment-Thickening, Stabilization, Design of Sludge Digester, Conditioning, Dewatering, Drying, Ultimate Disposal of Sludge Solids		
Module 5	Disposal of Wastewater	Hrs. 6

Need of Disinfection, Self-Purification, DO Sag Curve, Streeter Phelp's Model, Stream Classification, Effluent Standards for Discharge into Surface Water & on Land

Text Books:

1	Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Environmental Engineering" Vol. II, Laxmi Publications (P) Ltd.
2	M.N. Rao, A.K. Datta, "Wastewater Treatment: Theory and Design", Oxford & IBH Publishing Co.
3	S.K. Garg, "Environmental Engineering", Khanna Publishers
4	G.S. Birdie, J.S. Birdie, "Water Supply and Sanitary Engineering" Dhanpat Rai & Co. Pvt. Ltd.

Reference Books:

1	Peavey, H.S. Rowe, D.R., and Tchobanoglous, Environmental Engineering, McGraw-Hill Book Company.
2	Viessman W. and Hammer M.J. Water supply and pollution Control, Harper Collins College publishers.
3	Hammer M.J. Water and Waste water Technology, Prentice-Hall of India P.Ltd.
4	Metcalf & Eddy, Waste Water Engg. Treatment & Disposal, Tata McGraw Hill.
5	Manual on sewerage and sewage Treatment systems – CPHEEO, Government of India in collaboration with JICA.

SUBJECT CODE		Hydraulics Engineering						CREDITS	
25AF1922PC403								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: On completion of course, 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 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 & Construction				CREDITS	
25AF1922PC404						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 the fundamental principles of building planning, orientation, and sustainability.
COBJ2	To familiarize students with national building codes and planning norms for different residential

	structures.
COBJ3	To introduce essential building services like water supply, drainage, electrification, fire safety, and HVAC systems.
COBJ4	To study masonry construction techniques using different types of materials and bonds.
COBJ4	To provide knowledge about building components like doors, windows, stairs, floors, and roofs with appropriate materials and types.

Course Outcomes: On completion of course, students will be able to	
CO1	Apply principles of building planning and orientation with reference to environmental considerations and green building concepts.
CO2	Interpret and use building byelaws and codes in planning residential buildings and navigate the building approval process.
CO3	Design basic building service systems including plumbing, electrification, fire safety, and HVAC.
CO4	Identify and differentiate between various masonry materials, construction methods, and partition wall types.
CO5	Select appropriate types of stairs, doors, windows, flooring, and roof coverings based on building requirements and standards.

Course Contents

Module 1	Principles of building planning	Hrs. 8
Principles of building planning, significance sun diagram, wind diagram, orientation, factors affecting, and criteria under Indian condition, concept of green building: aspect at planning level, construction stage and operational level.		
Module 2	Building Bye-Laws & Planning Essentials	Hrs. 8
Building planning byelaws & regulations as per SP-7, National Building Code of India group 1 to 5, planning of residential building: bungalows, row bungalows, apartments and twin bungalows, procedure of building permission, significance of commencement, plinth completion or occupancy certificate		
Module 3	Building Services	Hrs. 8
<p>Plumbing: Various materials for system like stoneware, GI, AC, CI, PVC, HDPE and various types of traps, fittings, chambers, need of septic tank, concept of plumbing & drainage plan, introduction to rainwater harvesting, concept of rainwater gutters, rainwater outlet & down tank systems.</p> <p>Electrification: wiring types, requirements & location of various points, and concept of earthing.</p> <p>Fire resistance in building: Fire protection precautions, confining of fire, fire hazards, characteristics of fire resisting materials.</p> <p>HVAC Systems: Principles & Materials in Ventilation, Air conditioning, Thermal Insulation.</p>		
Module 4	Masonry Construction	Hrs. 6
Stone masonry: Random rubble, un-coursed rubble, coursed rubble & ashlar, brickwork & brick bonds - english, flemish, principles to be observed during construction composite masonry, various partition walls, brick, aluminum & timber, solid concrete blocks, hollow concrete blocks and light weight blocks (aerated autoclaved), soil stabilized blocks, fly ash blocks, cement concrete walls.		
Module 5	Building Components	Hrs. 6

Doors and windows-Doors - classification based on parameters such as material, geometry, fixtures and fastening
Windows - classification based on parameters such as material, geometry, fixtures and fastening
Stairs: Terminology, requirements of a good stair, functional aspects, various types, uses and limitations
Elevators: Types and their Use
Flooring: Types, factors for selections of floorings, flooring in ground and upper floors, various types of tiled flooring: natural, composite, synthetic, and special purpose flooring, concrete flooring for industrial purpose: tremix flooring
Roof coverings: Terms used, roof and their selection, pitched roofs and their types, roof coverings and their selection. Natural, composite, synthetic, and special purpose roof coverings, timber trusses (King Post and Queen Post), steel trusses types and their suitability

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., “Automation Systems in Smart and Green Buildings”, Khanna Publishers, N. Dehli ISBN No 978-81-7409-237-3
4	Jain V.K., “Handbook of Designing and Installation of Services in High Rise Building Complexes”, Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-245-8

Reference Books:	
1	Deodhar S.V., “Building Science and Planning”, Khanna Publishers, N. 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,

SUBJECT CODE	OPEN ELECTIVE-II				CREDITS		
25AF1ARPOEM05	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 provide knowledge of tachometric systems and principles for effective application in contouring and traversing.
COBJ2	To develop understanding of different types of curves and techniques for their setting out

COBJ3	To introduce fundamental concepts of aerial photogrammetry, including interpretation and measurement from aerial photographs.
COBJ4	To familiarize students with principles and components of remote sensing and GPS, emphasizing their practical applications.
COBJ5	To explain the basics of GIS and its integration with remote sensing for civil engineering applications.

Course Outcomes: On completion of course, students will be able to	
CO1	Apply tacheometric methods for field data collection in contouring and traverse surveys.
CO2	Analyze and set out different types of curves (circular, compound, reverse, vertical) using appropriate field techniques
CO3	Interpret aerial photographs and perform basic calculations like scale, relief displacement, and parallax.
CO4	Demonstrate understanding of remote sensing and GPS systems and apply them in geospatial data collection and analysis.
CO5	Utilize GIS tools and data for solving civil engineering problems in domains like transportation, urban planning, and environmental studies.

Course Contents

Module 1	Tacheometry	Hrs. 8
Tacheometry: Tachometric systems and principles, stadia system, uses of analytic lens, tangential system, subtense system, instrument constant, field work reduction, direct-reading tacheometer, use of tacheometry for traversing and contouring. .		
Module 2	Curves	Hrs. 8
Curves: Classification and use; elements of circular curves, calculations, setting out curves by offsets and by theodolites, compound curves, reverse curves, transition curves, vertical curves, setting out.		
Module 3	Total Station	Hrs. 6
Introduction to Total Station: Principle and Function, REM, RDM, Use of Total station for data processing and analysis, Field work: Point data collection (Easting, Northing and Height),		
Module 4	Remote sensing & GPS Surveying	Hrs. 8
Remote Sensing: Principle, components, classification, remote sensing data acquisition process, different types of remote sensing satellite imagery with special relevance to Indian Remote Sensing Satellites (IRS) and applications. GPS Surveying: Introduction & components of GPS, Space segment, control segment and user segment, Elements of Satellite based surveys-Map datums, GPS receivers, GPS observation methods and their advantages over conventional methods.		
Module 5	Geographical Information System:	Hrs. 8
Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).		

Text Books:	
1	A.M. Chandra, “Advance Surveying ”, New Age International Publishers N. Delhi.
2	S.K. Duggal , “Surveying Vol. II ”, Tata McGraw Hill Publishing Company Ltd. New Delhi.
3	T.P. Kanetkar and S.V. Kulkarini , “ Surveying and Leveling-Part- II ”, Pune Vidyarthi Griha Prakashan, Pune
4	Basak, N. N., “ Surveying and Levelling ”, Tata McGraw-Hill Education, Delhi
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	Engineering Surveying : Theory and Examination Problems for Students by W. Schofield, Butterworth, Heinemann,Oxford.
2	Remote Sensing and image interpretation by Lillesand T.M. and Kiefer R.W.
3	Mohinder, S. G., Lawrence, R. W. and Angus, P. A. (2001): Global Positioning Systems, Inertial Navigation and Integration, John Wiley and Sons Inc., New York
4	Satheesh, G., Sathikumar, R. and Madhu, N. (2007): Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education, Delhi

SUBJECT CODE		OPEN ELECTIVE-II				CREDITS	
25AF1ARPOEM05		K. 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:	
CO1	To introduce the concepts and working mechanisms of GPS used in modern surveying, including data collection and post-processing techniques.
CO2	To impart knowledge about the principles and applications of Total Station, focusing on data collection and analysis methods.
CO3	To develop understanding of Electronic Distance Measurement (EDM) techniques and their implementation in various survey applications.

CO4	To provide an overview of remote sensing technology, including satellite imagery and its relevance to civil engineering.
CO5	To explain the concepts and components of Geographic Information Systems (GIS) and their integration with remote sensing for civil engineering applications.

Course Outcomes: On completion of course, students will be able to	
CO1	Demonstrate the ability to use GPS for surveying, understand coordinate systems, and apply post-processing techniques to field data.
CO2	Operate Total Station instruments to collect accurate field data and apply it in mapping and elevation analysis.
CO3	Apply Electronic Distance Measurement techniques to perform area, height, and distance-based surveys with precision.
CO4	Explain the principles and data acquisition techniques of remote sensing and relate satellite imagery to civil engineering applications.
CO5	Use GIS tools to analyze spatial data and integrate remote sensing outputs for applications in transportation, urban planning, and infrastructure development.

Course Contents

Module 1	Surveying with GPS	Hrs. 8
Introduction of GPS: Concepts, Mechanism and Pre requirements of the GPS Survey, Coordinate and time systems, Satellite orbital motions, GPS observables, • Estimation procedures, Propagation medium, Methods of post processing GPS data, Instrument handling and setting, Field work, Survey data post processing, Survey data applications.		
Module 2	Total Station	Hrs. 6
Introduction to Total Station: Principle and Function, REM, RDM, Use of Total station for data processing and analysis, Field work: Point data collection (Easting, Northing and Height),		
Module 3	Electronic Distance Measurement	Hrs. 6
Electronic Distance Measurement Survey, Area Measurement Survey Height Measurement Survey, Survey Data Post Processing, Survey Data Applications.		
Module 4	Remote sensing	Hrs. 6
Remote Sensing: Principle, components, classification, remote sensing data acquisition process, different types of remote sensing satellite imagery with special relevance to Indian Remote Sensing Satellites (IRS) and applications.		
Module 5	Geographical Information System:	Hrs. 8
Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering (transportation, town planning).		

Text Books:	
1	A.M. Chandra, “Advance Surveying”, New Age International Publishers N. Delhi.

2	S.K. Duggal , “Surveying Vol. II ”, Tata McGraw Hill Publishing Company Ltd. New Delhi.
3	T.P. Kanetkar and S.V. Kulkarni , “ Surveying and Leveling-Part- II ”, Pune Vidyarthi Griha Prakashan, Pune
4	Satheesh, G., Sathikumar, R. and Madhu, N, “Advanced Surveying: Total Station, GIS and Remote Sensing ”, Pearson Education, Delhi
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: On completion of course, 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	NPTTEL 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
25AF1000VE407								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:	
CO1	Analyze Chhatrapati Shivaji Maharaj's leadership qualities, strategic thinking, and management skills.
CO2	Develop critical thinking and problem-solving skills through case studies and discussions.
CO3	Recognize the relevance of the Chhatrapati's principles and values in modern times.

Course Outcomes: On completion of course, 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 style="margin: 0;">Waste Water Engineering Lab</h1>				CREDITS	
25AF1192PCL408						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	Quantify the pollutant concentration in water, wastewater and ambient air.
CO2	Recommend the degree of treatment required for the water and wastewater.
CO3	Analyze the survival conditions for the microorganism and its growth rate.

Course Contents

Practical Work consists of study on Sampling and preservation of samples, preparation of Standard Solutions along with, performance of at least six experiments from the List below:

Experiment No 1	Determination of pH and Alkalinity
Experiment No 2	Determination of Chlorides
Experiment No 3	Determination of Turbidity and optimum dose of alum
Experiment No 4	Determination of Sulphates
Experiment No 5	Determination of Total Solids, Dissolved Solids & Suspended Solids
Experiment No 6	Determination of Dissolved Oxygen
Experiment No 7	Determination of Hardness
Experiment No 8	Determination of Chlorine demand and residual chlorine
Experiment No 9	Determination of MPN
Experiment No 10	Determination of Fluorides and Iron
Experiment No 11	Determination of Sludge Volume Index (SVI)
Experiment No 12	Determination of BOD and COD
Further, a Site Visit to Waste Water Treatment Plant shall be conducted and a report based on the visit to water treatment plant shall be submitted.	

SUBJECT CODE		<h2>Hydraulics Lab</h2>				CREDITS	
25AF1922PCL409						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: On completion of course, 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 & Construction Lab				CREDITS	
25AF1922PCL410						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: On completion of course, students will be able to	
CO1	Draw plan, elevation and section of load bearing and framed structures.
CO2	Draw plan, elevation and section of framed structures.
CO3	Draw plan, elevation and section of public structures.

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 shall be insisted.

Experiment No.1	Assignments in the form of free-hand proportioned sketches to be drawn in sketch book for Stone and Brick Masonry, Doors & Windows.
Experiment No.2	Planning & design of a building (Minimum G+1): Full set of drawings for: 1) Municipal Submission drawing as per local statutory body bye-laws such as Town Planning, Municipal Council or Corporation Authorities. 2) Foundation / Center Line Drawing. 3) Furniture layout plan. 4) Electrification plan. 5) Water supply & drainage plan. 6) Project report giving details of Drainage System, Water Supply System, Water Tank, Septic Tank Design of terrace Drainage System. 7) Rain water harvesting systems
Experiment No.3	Setting out of planned building actually on ground using conventional or modern surveying instruments
Use of drafting software such as Auto Cad is expected for drawing of sheets.	

SUBJECT CODE		Entrepreneurship Development Process				CREDITS	
25AF1922HM411						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: On completion of course, 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