Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering in Civil

(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE

For Affiliated Colleges

Semester – III & IV

W.E.F. 2025 – 26

Syllabus Structure for Second Year Engineering (Semester – III, Level – 5.0) (Civil) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-301	Engineering Mechanics	PCC	3			3	40	60			100	3
CE-302	Engineering Mechanics Lab	PCC			2	2			25	25 (OR)	50	1
CE-303	Surveying and Geomatics	PCC	3			3	40	60			100	3
CE-304	Surveying and Geomatics Lab	PCC			2	2			25	25 (PR)	50	1
CE-305	Materials, Testing and Evaluation Lab	PCC	1		2	3			25	25 (OR)	50	2
CE-306	Engineering Geology	MDM	2			2	40	60	25		125	2
OE-307	Open Elective – I	OE	3			3	40	60			100	3
CE-308	Project Management	HSSM	2			2						2
CE-309	Universal Human Values	HSSM	1		2	3			25		25	2
CE-310	Community Engagement Project / Field Project	ELC			4	4			50		50	2
			15		**12**	**27**	**160**	**240**	**175**	**75**	**650**	**21**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

CA: College Assessment UA: University Assessment

Syllabus Structure for Second Year Engineering (Semester – IV, Level – 5.0) (Civil) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-401	Fluid Mechanics	PCC	3			3	40	60			100	3
CE-402	Fluid Mechanics Lab	PCC			2	2			25	25 (OR)	50	1
CE-403	Solid Mechanics	PCC	3			3	40	60			100	3
CE-404	Solid Mechanics Lab	PCC			2	2			25	25 (OR)	50	1
CE-405	Concrete Technology Lab	PCC	1		2	3			25	25 (OR)	50	2
CE-406	Biology for Engineers	MDM	2			2	40	60	25		125	2
OE-407	Open Elective – II	OE	3			3	40	60			100	3
CE-408	Building Design and Drawing Lab	VSEC			2	2			25		25	1
CE-409	Ability Enhancement Course	AEC			2	2			25		25	1
CE-410	Economics for Engineers	HSSM	2			2						2
CE-411	Environmental Sciences	HSSM	2			2		25			25	2
			16		**10**	**26**	**160**	**265**	**150**	**75**	**650**	**21**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

CA: College Assessment UA: University Assessment

EXIT COURSE FOR U. G. DIPLOMA in Civil (DURATION 8 WEEKS)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-412	Internship / Apprenticeship	OJT							125			4
CE-413	Mini Project	Project							25			4
									150			8

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Second Year Bachelor of Engineering

in

Civil

(As per NEP 2020 Guidelines)

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'A' Grade
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(4th Cycle)

COURSE OUTLINE

For Affiliated Colleges

Semester – III

W.E.F. 2025 – 26

ENGINEERING MECHANICS (PCC)					
COURSE OUTLINE					
Course Title:	**ENGINEERING MECHANICS**	**Short Title:**	**EM**	**Course Code: Theory**	**CE - 301**

Course description: This course is to provide an introduction to solid mechanics to the students of civil engineering, develop fundamental concept of applied and non-applied forces, its application. Course also helps to develop the concept of centroid, moment of inertia and its application in design of civil engineering structure.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	03	15	45	03
Practical	02	15	30	01

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Understand the concept of applied and non-applied forces.
2. Understand the concept of analysis of statically determinate structure.
3. Understand the concept of center of gravity, centroid, and moment of inertia.
4. Understand the application of Newton's laws of motion and its application.
5. Understand the concept of equation of motion and its application.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concept of applied and non-applied forces.
2. Apply the knowledge of equilibrium to analyze statically determinate structure.
3. Evaluate centroid and moment of inertia for various sections, required for design of civil engineering structure.
4. Distinguish a Newton's law of motion and its application.
5. Develop lifelong learning about solid mechanics and its application in civil engineering.

COURSE CONTENT

ENGINEERING MECHANICS		**Semester:**	**III**	**Course Code**	**CE – 301**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12
Introduction to Engineering Mechanics: Fundamental principles, basic concepts, concept of force, scalar and vector quantities. Resultant of force system: Composition and resolution of force, resultant of coplanar concurrent force system. Concept of moment and couple: Varignon's theorem, resultant of non-concurrent coplanar force system. Equilibrium of coplanar force system, concept of equilibrium, condition of equilibrium, free body diagram. Types of supports and support reactions, equilibrium of forces in plane. Friction: Introduction to friction, laws of friction, friction on horizontal and inclined planes, Ladder Friction, wedge friction. (No numerical treatment)		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Analysis of statically determinate structure: 1. Beams with different support conditions, (Numerical on Simply supported, Cantilever beam, overhang beam with point load, uniformly distributed load and couple only). 2. Cables and frames, 3. Simple trusses: method of joints and method of sections. (Numerical on forces in the members should not be more than 5 in continuation)		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Centroid and Centre of Gravity: Introduction, Centroid of simple figures (rectangle, triangle) from first principle, centroid of composite figures. Concept of centre of Gravity, Center of mass and its implication. Moment of inertia – Introduction, moment of inertia of simple figures (rectangle, triangle) from first principle, perpendicular axis theorem, parallel axis theorem, moment of inertia of standard geometrical shape (Numerical on T and L section only). Concept of free vibrations of undamped SDOF system. (No numerical treatment).		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Kinematics of particles: Rectilinear motion, equation of motion, types of rectilinear motion.		

(Numerical on acceleration due to gravity and rectilinear motion with constant acceleration.

Curvilinear motion: rectangular coordinate, normal and tangential components, and path coordinates. (Numerical on rectangular co-ordinate and normal and tangential component).

Projectile motion.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Newton's second law,

D' Alembert's principle,

Work energy principle, (No numerical treatment)

Impulse and momentum principle (No numerical treatment)

Types of impact

Text Books:

1. Bhavikatti S. S. & K. G. Rajashekarappa, "Engineering Mechanics", New Age International (P) Ltd., Publishers.

Reference Books:

1. F P Beer and E R Johnson, "Mechanics for Engineers – Statics", McGraw-Hill Publication.
2. F P Beer and E R Johnson, "Mechanics for Engineers – Dynamics", McGraw-Hill Publication.
3. S P Timoshenko and D H Young, "Engineering Mechanics", McGraw- Hill Publications.
4. R C Hibbeler, "Engineering Mechanics statics and dynamics", Pearson Education.
5. S R Bendale, "Engineering Mechanics", John Wiley & Sons, Delhi, 1st Edition.
6. Jaget Babu, "Engineering Mechanics", Pearson Education, Delhi, 1st Edition.
7. Bansal R.K., A Text Book of Engineering Mechanics, Laxmi Publications.
8. Khurmi R.S., Engineering Mechanics, S. Chand & Co.
9. Tayal A.K., Engineering Mechanics, Umesh Publication

NPTEL Links:

NPTEL :: Mechanical Engineering - NOC:Engineering Mechanics by K. Ramesh, IIT Madras

<table>
<tr><th colspan="6">ENGINEERING MECHANICS LAB (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">ENGINEERING MECHANICS LAB</td><td>Semester:</td><td>III</td><td>Course Code</td><td>CE -302</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td rowspan="2">Practical:</td><td rowspan="2">2 hours/week</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 Marks</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) UA:</td><td>25 Marks (OR)</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) Pattern:</td><td colspan="3">Oral (OR)</td></tr>
<tr><td colspan="6">Concerned faculty member should suitably frame SEVEN laboratory assignments from the following list.

LIST OF PRACTICAL: (Any Seven)

1. Study of vectors.
a. To calculate resultant of coplanar forces.
b. To calculate unknown force (reaction).

2. Verification of law of polygon of forces
a. To verify law of polygon of forces.
b. To calculate analytically and experimentally resultant of concurrent force system.
c. To compare analytical values with measured ones.

3. Verification of Lami’s theorem.
a. To Verify Lami’s theorem.
b. To observe the ratios of and compare the same.

4. Forces in jib crane
a. To study law of triangle of forces analytically and graphically.
b. To apply conditions of equilibrium.
c. To calculate forces in members of jib crane.
d. To compare the theoretical results with experimental values.

5. Reactions of beam.
a. To verify conditions of equilibrium of a system of coplanar parallel forces using reaction of beam apparatus.
b. To understand active and reactive forces.</td></tr>
</table>

6. Simple friction on horizontal and inclined planes.

a. To describe frictional force, limiting friction, coefficient of friction, angle of repose.

b. To know the concept that the Force ∝ Reaction.

c. To find coefficient of friction for bodies in equilibrium on inclined planes.

7. Study of simple machines and verification of law of machines

a. To describe efficiency, load, effort, velocity ratio, frictional effort and verify law of machines.

b. To establish the law of machine from graph.

8. Graphical work (Statics)

a. To understand graphical method to solve the problems in statics.

b. To solve the problem on coplanar concurrent forces, parallel forces and reactions of beam by graphical method.

c. To describe Bow's notation, space diagram, vector diagram, polar diagram, funicular diagram and to draw the same.

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

SURVEYING AND GEOMATICS (PCC)

COURSE OUTLINE

Course Title:	**SURVEYING AND GEOMATICS**	**Short Title:**	**SURG**	**Course Code: Theory**	**CE-303**

Course description: This course introduce the students about concept in surveying such as Scope of geodetic surveying and triangulation in civil engineering society, Adjustment of triangulation figure by using different methods, Terrestrial and aerial photography for large scale survey, Principles of remote sensing and its methods, Locating of sounding in hydrographic surveying, Importance and principles of Total station, Setting of curves on roads and railways.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	**03**
Practical	02	15	30	**01**

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Identify and calculate the theory of errors in measurement in Triangulation survey.
2. Operate Total station to perform all measurement.
3. Calculate air base distance, overlap, and height of object in photographs.
4. Relate the knowledge gained after using nautical sextant in hydro graphic survey.
5. Setting out the curves on roads and railways.
6. Relate the knowledge about Geodetic survey.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concept of calculation of azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse.
2. Evaluate aerial photos with respect to overlap, air base distance.
3. Analyze the data after field survey.
4. Apply the knowledge of survey in setting out curves on roads and railways.
5. Create lifelong learning in the field survey and Geodetic survey in remote areas.

<table>
<tr><td colspan="6">COURSE CONTENT</td></tr>
<tr><td colspan="2">SURVEYING AND GEOMATICS</td><td>Semester:</td><td>III</td><td>Course Code</td><td>CE – 303</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td>Lectures:</td><td>3 hours/week</td><td colspan="3">End Semester Exam (ESE) UA:</td><td>60 marks</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Duration of ESE:</td><td>03 hours</td></tr>
<tr><td colspan="3">Internal Sessional Exam (ISE) CA:</td><td>40 marks</td></tr>
<tr><td colspan="2">Unit–I:</td><td colspan="2">No. of Lectures: 09 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="6">Introduction to surveying:

Surveying- Definition, principle of surveying, Primary division of Surveying, Classification of surveys, Linear measurement by Metric Chain, Steel tape, to find error in length due to incorrect chain or tape , instrument for setting right angles by cross staff or optical square.

Prismatic Compass, conversion of whole circle bearing to reduced bearing, Local attraction & computation of interior angles of the traverse.</td></tr>
<tr><td colspan="2">Unit–II:</td><td colspan="2">No. of Lectures: 09 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="6">Leveling & Contouring :

Methods of leveling, study of various terminology used in leveling, Dumpy Level : temporary adjustments of a level, Leveling staff, booking and reducing level : Height of instrument method & Rise &Fall Method, Differential leveling, profile leveling, cross sectioning & reciprocal leveling

Contour: definition, characteristics of contours & uses of contours, methods of locating of contour, contour gradient.</td></tr>
<tr><td colspan="2">Unit–III:</td><td colspan="2">No. of Lectures: 09 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="6">Theodolite :

Main parts of a Transit Theodolite, Temporary adjustment of theodolite, relationship between the fundamental axes of theodolite, Measurement of Horizontal angle by (i) Repetition Method (ii) Reiteration method, Measurement of Vertical angle, Theodolite Traverse Survey : Computing Consecutive & Independent Coordinates, balancing of closed traverse by Bowditch Rule, Transit rule or Third rule. Details of GALES Traverse table.

Introduction of electronic theodolite (i) Wild T-1000 ‘THEMAT’ (ii) Wild T-2000 & T-2000S.</td></tr>
</table>

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Tachometry:

Principle of stadia method, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Numerical on Tachometry on fixed hair method.

Plane Table Survey: Accessories of a plane table, orientation, set up of plane table over station, methods of plane tabling.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Trigonometric leveling:

To find the differences in elevations between the instrument station and the object : Case1 : Base of the object accessible, Case2: Base of the object inaccessible (i) instrument stations in the same vertical pane as the elevated object (ii) instrument station not in same vertical plane.

Photogrammetry: Introduction, types of photograph, Terrestrial & Aerial Photogrammetry Aerial camera lens & its basic components, focal plane & Fiducially marks, photo coordinate measurements, vertical photographs & its Scale, photographic overlaps & its benefits, effective coverage of a photograph

Total station: operation of total station, orientation, setting up, measurement of angles & distances, measuring horizontal & vertical angles.

Text Books:

1. Surveying and leveling (vol-I&II) by T.P. Kanitkar, & S.V. Kulkarni, Pune Vidarthi Griha Prakashan, Pune.

Reference Books:

1. Advance surveying by P.Som , B.N.Ghosh, TMH Publication.
2. Surveying and leveling, by N N Basak, Vol.I & II,McGraw Hill Education (India) private Limited New Delhi.
3. Elements of Photogrammetry by Paul Richard Wolf, McGraw-Hill Education (India) Pvt Limited.
4. Plane and geodetic surveying by David Clark, J. E. Jackson
5. Principal of remote sensing by A. N. Patel 6. Concept and techniques of Geographic

Information System , by C P LO Albbert K W Yeung ,Prentice Hall of India Private Limited , New Delhi

6. Surveying Vol. I ,Vol .II and III ,by Dr B.C.Punmia,Ashok K Jain, Arun K Jain , Laxmi Publication (P) New Delhi.
7. Principles of surveying by Cliver and clendening
8. Advance surveying , Vol.I & II, Handbook by P.B. Shahani
9. A handbook of accurate surveying methods by S.P.Collins
10. Surveying by, S K Duggal , Vol.I & II, McGraw Hill Education (India) private Limited New Delhi.
11. Introduction to Geographic information systems, by Kang- tsung Chang, McGraw Hill Education (India) private Limited New Delhi. 8 Surveying by, C L Kochher, Dhanpat Rai publications co. New Delhi

NPTEL Links:

1. https://youtu.be/tMHBr748PpA " General Introduction On Modern Survey" by prof S K Ghosh IIT Rookee
2. https://youtu.be/qDmu_r12TU8 " Photo graphic Overlap" By S K Ghosh IIT Roorkee

SURVEYING AND GEOMATICS LAB (PCC)					
LAB COURSE CONTENT					
SURVEYING AND GEOMATICS LAB		**Semester:**	**III**	**Course Code**	**CE – 304**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**		**25 Marks**	
		End Semester Exam (ESE) UA:		**25 Marks (PR)**	
End Semester Exam (ESE) Pattern:		**Practical (PR)**			

Concerned faculty member should suitably frame **SIX** laboratory assignments from the following list.

LIST OF PRACTICAL- Any six practicals should be performed.

1. Use and Study of Dumpy level for finding the levels by various methods. Measurements of horizontal and vertical angles by transit Theodolite
2. Measurements of horizontal angles of a triangle by repetition method
3. Computation of horizontal distances and elevations by Tachometry for horizontal and inclined sights
4. Radiation and intersection method in plane Table survey

5. Theodolite Traverse survey project of a closed traverse with at least four sides.
6. Tachometric contouring project with at least two instrument stations at 60 m apart
7. Road project for minimum length of 200 m, including fixing of alignment, profile leveling, and cross sectioning
8. Plane table survey project of a closed traverse of minimum four side
9. Measurement of horizontal and vertical angles by One Second Theodolite
10. Study and use of mirror stereoscope and finding out the air base distance
11. Measurement of angles and elevation by Total Station.

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

MATERIAL TESTING AND EVALUATION LAB (PCC)					
COURSE OUTLINE					
Course Title:	**MATERIAL TESTING AND EVALUATION LAB**	**Short Title:**	**MTE – LAB**	**Course Code: Theory**	**CE - 305**

Course description:

In construction industry a number of materials are required for construction. As a civil engineer student should study IS code for testing procedure and specific limits of those particular materials used in construction industry.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	01	15	15	02
Practical	02	15	30	

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Understand the IS code required for different material testing procedure.
2. Understand specified limits as per IS code and its necessity for different materials and application.
3. Understand the procedure, by conducting the practical in laboratories.
4. Understand the necessary care and precaution during the lab work and its implication on site.
5. Understand the concept of effective and efficient use of material on site.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand and remember the relevant IS codes required for various construction materials.
2. Apply knowledge from IS code in conducting the practical in laboratory.
3. Analyze the different properties of construction material as per IS code procedure.
4. Evaluate the suitability of construction materials for different application in construction work.
5. Develop the ideas, so the material will be efficiently use in construction activity.

<table>
<tr><th colspan="6">COURSE CONTENT</th></tr>
<tr><td colspan="3">MATERIAL TESTING AND EVALUATION LAB</td><td>Semester:</td><td>III</td><td>Course Code</td><td>CE – 305</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="5">Examination scheme</td></tr>
<tr><td>Lectures:</td><td>1 hour/week</td><td colspan="4">Internal Continuous Assessment (ICA) CA:</td><td>25 Marks</td></tr>
<tr><td>Practical:</td><td>2 hours/week</td><td colspan="4">End Semester Exam (ESE) UA:</td><td>25 Marks (OR)</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) Pattern:</td><td colspan="4">Oral (OR)</td></tr>
<tr><td colspan="2">----</td><td colspan="3">No. of Lectures: 14 Hours</td><td colspan="2">----</td></tr>
<tr><td colspan="7">Introduction to Engineering Materials:

Aggregates: Sources, classification.

Concept and importance of shape, size, texture, strength and their influence on different application in construction work.

Determination of different properties of aggregate like specific gravity, water absorption and moisture content, thermal properties of aggregates, grading of aggregates, flakiness index, elongation index, bulk density and crushing value, and impact value by relevant IS code method.

Bricks: Shape, size, color of bricks. Composition of good brick earth, classification of burnt brick, manufacturing of bricks, qualities of good bricks, test on bricks.

Paver Block: Shape, size, color of paver block. Composition of good paver block, classification of paver block, manufacturing of paver block, qualities of paver block, test on paver block.</td></tr>
<tr><td colspan="7">Concerned faculty member should suitably frame SIX laboratory assignments from the following list.

LIST OF PRACTICAL: (Any Six)

1. Fineness modulus of sand.
2. Moisture content of sand.
3. Aggregate impact value
4. Crushing value of aggregate
5. Specific gravity of aggregate.
6. Flakiness and elongation index of aggregate.
7. Shape and size of bricks.</td></tr>
</table>

8. Efflorescence of Bricks.
9. Crushing strength of Bricks
10. Moisture content of Paver block
11. Compressive strength of Paver block
12. Tests on Tiles

Text Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann.

Reference Books:

1. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
2. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
3. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards* (post 2000)
4. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition.
5. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications.
6. Concrete Technology by M S Shetty, S Chand Publication.
7. Building Materials by S C Rangwala, Charotar Publishing House, India.

NPTEL Links:

https://archive.nptel.ac.in/courses/105/104/105104030/ by Sudhir Mishra, IIT Kanpur

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each practical/assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:
ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

ENGINEERING GEOLOGY (MDM)					
COURSE OUTLINE					
Course Title:	**ENGINEERING GEOLOGY**	**Short Title:**	**EG**	**Course Code: Theory**	**CE 306**

Course description: This course introduce the students about concept in surveying such as Scope of geodetic surveying and triangulation in civil engineering society, Adjustment of triangulation figure by using different methods, Terrestrial and aerial photography for large scale survey, Principles of remote sensing and its methods, Locating of sounding in hydrographic surveying, Importance and principles of Total station, Setting of curves on roads and railways.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**02**	**15**	**30**	**02**

Prerequisite course(s): Nil

Course Objectives:

The objective of this Course is to focus on the core activities of engineering geologists – site characterization and geologic hazard identification and mitigation. Through lectures, labs, and case study examination student will learn to couple geologic expertise with the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects and the quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction.

Engineering geology is an applied geology discipline that involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works. Engineering geology also includes the assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation.

Course outcomes:

After successful completion of this course the student will be able to:

1. Analyze geological data, site characterization and prepare report.
2. Understand the fundamentals of the engineering properties of earth materials.
3. Evaluate rock mass characterization and the mechanics of rock.
4. Develop concept of soil characterization and the unified soil classification system.
5. Apply the knowledge of mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

COURSE CONTENT

ENGINEERING GEOLOGY		**Semester:**	**III**	**Course Code**	**CE – 306**
Teaching Scheme:		**Examination scheme**			
Lectures:	**2 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures: 06 Hours**	**Marks: 12**

Mineralogy:

Mineral, Origin and composition. Physical properties of minerals, Rock forming minerals, megascopic identification of common primary & secondary minerals. Folic and mafic, essential and accessories minerals.

Unit–II:	**No. of Lectures: 06 Hours**	**Marks: 12**

Petrology:

Rock forming processes. Chemical and Mineralogical Composition. Texture and structures, classification. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of classic rocks. Classification of sedimentary rocks and their characteristics. Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures in metamorphic rocks.

Unit–III:	**No. of Lectures: 06 Hours**	**Marks: 12**

Structural Geology:

Dip and Strike. Outcrop. Inliers and Outliers. Main types of discontinuities. Fold- parts and Types with sketches, Faults: parts and types with sketches, Joints, & fractures, Unconformity and its types. Engineering applications of fold, fault, and joint fracture.

Ground Water-

Definition, sources, water table, depth zones of ground water, perched water table, artesian wells, conservation of ground water, cone of depression, ground water condition in Deccan trap areas.

Unit–IV:	**No. of Lectures: 06 Hours**	**Marks: 12**

Preliminary geological Investigation:

Surface survey and subsurface survey, methods of drilling, limitations of drilling, precautions during drilling, core logging, fracture surfaces of dill core, Core recovery, rock quality

designation RQD, quantity and quality of drill water

Good building stones: Characteristics of good building stones and its case studies.

Lithology: Main geographic divisions of India, Archean, Dharwar, Cuddapha, Vindhyan Gondwana, and Deccan trap its occurrence, rock types, structures, Soil conversation.

Unit–V:	**No. of Lectures: 06 Hours**	**Marks: 12**

Geology of dam and reservoir site

Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures. Dams on various rocks and geological structures and its engineering importance

Tunnel

Required geological consideration for selecting tunnels , Favorable & unfavorable conditions in different types of rocks in presence of various structural features, treatment giving unfavorable structures tunneling in Deccan trap areas. Tunnels in various rocks and geological structures and its engineering importance

Text Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.

Reference Books:

1. R.B. Gupte: A Text Book of Engineering Geology -P.V.G. Publications, Pune.
2. M. Anji Reddy: A Text Book of Remote Sensing and Geographical Information Systems by-2nd Edition B S Publication.
3. R. Legget: Geology and Engineering - McGraw Hill Book Co., London.
4. Arthur Holmes: Physical Geology -ELBS Publication.
5. Tony Waltham: Fundamentals of Engineering Geology, SPON Press.
6. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
7. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

8. J.M. Treteth: Geology of Engineers, Princeton, Von. Nostrand.
9. K V G K Gokhale : Text Book of Engineering Geology, B S Publication

NPTEL Links:

https://enine.digimat.in/nptel/courses/video/105107208/L10.html

Guide lines for ICA:

The students must perform the assignments on each unit as prescribed in the syllabus and carryout the assignments given by the teacher. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

PROJECT MANAGEMENT (HSSM)					
COURSE OUTLINE					
Course Title:	**PROJECT MANAGEMENT**	**Short Title:**	**PM**	**Course Code: Theory**	**CE-308**

Course description:

Explore laws, forces, and matter properties while studying the management & its principle and decision making. Hands on demonstrations reinforce theoretical concepts, enhancing problem solving skills and preparing students for diverse industry opportunities .Gain practical insights and unlock a world of career possibilities in this dynamic management course.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**02**	**15**	**30**	**02**

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Cultivate practical problem-solving abilities in real-world project management scenario.
2. Foster critical thinking for analytical evaluation of complex phenomena.
3. Promote interdisciplinary thinking by integrating varied managerial and leadership concepts.

Course outcomes:

After successful completion of this course the student will be able to:

1. Demonstrate deep comprehension of diverse project contents principles and applications.
2. Exhibit advanced proficiency in solving diverse management problems.
3. Critical analysis of experimental data, literature, and theoretical models.
4. Apply integrated management knowledge to solve real-world challenges effectively.
5. Communicate scientific ideas persuasively through clear reports and presentations.

COURSE CONTENT

PROJECT MANAGEMENT		**Semester:**	**III**	**Course Code**	**CE – 308**
Teaching Scheme:		**Examination scheme**			
Lectures:	**2 hours/week**	**End Semester Exam (ESE) UA:**			--
		Duration of ESE:			--
		Internal Sessional Exam (ISE) CA:			--
Unit–I:	**No. of Lectures: 06 Hours**		**Marks: --**		

Basics of Management and its Principle: Meaning & definition of Management, Nature & Characteristics, Management Functions Need for Management Principles.

Social and Ethical Responsibilities of management: Globalization & Management, Challenges before Indian Managers, Social Responsibilities of management, Social Stakeholders- Measuring Social responsiveness- Managerial Ethics.

Management vs Administration, Levels of Management & their respective functions, Role of Manager's and Challenges of today's Manager.

Unit–II:	**No. of Lectures: 06 Hours**	**Marks: --**

Management Decision Making:

Introduction, Significance and Limitations of Rational Decision-making, Steps in decision-making process, Types of Managerial decisions, Decision making under certainty, uncertainty & risk.

Management Information System (MIS) & Mastering the art of decision making

Unit–III:	**No. of Lectures: 06 Hours**	**Marks: --**

Organization

Introduction-Definition of Organizing- Benefits of organizing, Traditional perspective on organizing –Close system vs open system , Formal vs Informal organization, Span of management, Process of Organizing.

Depart mentation: need, importance & bases of Depart mentation. Effective Organizing and Organizational Culture: Ensuring understanding of Organizational structure and organizational culture. Organizational Change and Stress Management ,Study of PWD Organization system

Unit–IV:	**No. of Lectures: 06 Hours**	**Marks: --**

Introduction: The Economics of business

Economics a field of study, tools & techniques of analysis, Basic problems of economics. Theories of early economist, Economic environment of business, Micro & macroeconomics, Demand and supply Analysis: Demand: Meaning and Law of Demand, Elasticity of Demand, Pricing Policies for Business, Price discrimination.

Unit–V:	**No. of Lectures: 06 Hours**	**Marks: --**

Fundamentals of Entrepreneurship Management:

Definition, Concept, Traits, Characteristics, Skills, Nature & Importance, classification of Entrepreneur, Concept & Theories of Entrepreneurship.

Leadership: Quality required for leadership.

Text Books:

1. Essentials of Management - Koontz & Weihrich– McGraw Hill

Reference Books:

1. Management – A global and entrepreneurial perspective- Heinz Weuihrich, Mark Cannice, Harold Koontz, MC Graw Hill Education 14 edition
2. Fundamental of Management – Donnely, Gibson, Lvancevich, IrwinMC Graw Hill
3. Management – Kathryn Bartol, David Martin MC Graw Hill
4. Essentials of Management –Andrew I DubrinThomsib (Indian Edition)
5. Contemporary Management- Goreth R Jones, Jennifer M. George MC Graw Hill (International Edition)
6. Principles of Management – Bhat & Kumar – Oxford University Press
7. Principles of Management: Text and Cases, 1e - Bhattacharyya – Pearson
8. Organization behavior by Suja R. Nair, Himalaya Publication House
9. Organization behavior by M. N. Mishra, Vikas Publication House
10. Modern Economic Theory: K.K.Dewett, S.Chand publications. New Delhi.
11. Indian Economy: Mishra- puri, Himalaya publication ltd.
12. Managerial Economics: H.CraigPeterson,W.CrisLewis,Prentice- Hall Of India, 3rd Ed.
13. The Dynamics Of Entrepreneurial Development & Management- Himalaya Publishing House 5th Edition , Vasant Desai.
14. Entrepreneurship- Robert D. Hisrich, Michael P. Peters,Tata Mc Graw Hill Pub.
15. Entrepreneurship Development in India-Gupta, Srivivasan- Sultan Chand & Sons

NPTEL Links:

1. https://youtu.be/ZU5GNISl2sc by Dr M K Barua , IIT Roorkee
2. https://youtu.be/v9YkwuPPWxQ by Prof Vinayshi Gautam IIT Delhi

Guidelines: The concerned faculty shall suitably frame **FIVE** assignments based on above syllabus and the students must submit the assignments in the form of journal.

UNIVERSAL HUMAN VALUES (HSSM)					
COURSE OUTLINE					
Course Title:	**UNIVERSAL HUMAN VALUES**	**Short Title:**	**UHV**	**Course Code: Theory**	**CE – 309**

Course description:

Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self-exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, workplace and society, the comprehensive human goal in the society, the mutual fulfillment in the nature and the co-existence in existence. As a natural outcome of such inputs, they are able to evaluate an ethical life and profession ahead. Thus, this course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**01**	**15**	**15**	**02**
Practical	**02**	**15**	**30**	

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction.

Course outcomes:

After successful completion of this course the student will be able to:

1. Become more aware of themselves, and their surroundings (family, society, nature);
2. Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Have better critical ability.
4. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning will be made in this direction.

COURSE CONTENT

UNIVERSAL HUMAN VALUES		**Semester:**	**III**	**Course Code**	**CE – 309**
Teaching Scheme:		**Examination scheme**			
Lectures:	**1 hours/week**	**Internal Continuous Assessment**			**25 marks**
Practical:	**2 hours/week**				

Unit–I:	**No. of Lectures: 03 Hours**	

Introduction to Value Education

Understanding Value Education

Self-exploration as the Process for Value Education

Basic Human Aspirations and their Fulfilment

Right Understanding, Relationship and Physical Facility

Happiness and Prosperity – Current Scenario

Method to Fulfil the Basic Human Aspirations

Unit–II:	**No. of Lectures: 03 Hours**	

Harmony in the Human Being

Understanding the Human Being as 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		
Unit–III:	**No. of Lectures: 03 Hours**	
Harmony in the Family and Society Understanding Harmony in the Family – The Basic Unit of Human Interaction 'Trust' – The Foundational Value in Relationship Respect – As the Right Evaluation Other Values in Human-to-Human Relationship Understanding Harmony in the Society Vision for the Universal Human Order		
Unit–IV:	**No. of Lectures: 03 Hours**	
Harmony in the Nature (Existence) Understanding Harmony in Nature Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence		
Unit–V:	**No. of Lectures: 03 Hours**	
Implications of the Holistic Understanding – A Look at Professional Ethics Basis for Universal Human Values Definitiveness of (Ethical) Human Conduct Professional Ethics in the Light of Right Understanding A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession		

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 3rd Revised Edition, UHV Publications, 2023.

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, 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 – Pandit Sunderlal
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)
14. Reports, Papers and Impact Studies on UHV Implementation,
15. https://drive.google.com/drive/folders/1N_1Z1tIm8-iDfy9nQRcHbs_Bjtrk_d24
16. https://fdp-si.aicte-india.org/Activity_and_Impact.php
17. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics – Teachers Manual, 3rd Revised Edition, UHV Publications, 2023
18. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.
19. UHV-II: Universal Human Values: Understanding Harmony and Ethical Human Conduct https://fdp-si.aicte-india.org/UHVII.php
20. https://uhv.org.in/uhve

NPTEL Links:

1. About UHV Refresher for UHV-II – English, https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So
2. https://www.youtube.com/playlist?list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz

Guide lines for ICA:

Students must submit ICA in the form of journal with FIVE assignments / activities based on the practice sessions outlined in the Teacher's Manual encompassing a process of self-investigation and self-exploration, suitably framed by concerned teacher / faculty mentor.

The assessment, in this course, is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. shall be used in evaluation. The evaluation criteria for assessment are as follows.

Assessment by Teacher / faculty mentor: 05 marks

Self-assessment: 05 marks

Assessment by peers: 05 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Faculty in charge will assess the assignments continuously and grade or mark each assignment / activity on completion date declared for each assignment / activity.

COMMUNITY ENGAGEMENT PROJECT / FIELD PROJECT (ELC)					
COURSE OUTLINE					
Course Title:	**COMMUNITY ENGAGEMENT PROJECT / FIELD PROJECT (ELC)**	**Short Title:**	**CEP**	**Course Code: Theory**	**CE-310**

Course description:

The subject Community Engagement Project / Field Project involves activities that will expose students to the socio-economic issues in society so that the theoretical learning's can be supplemented by actual life experiences to generate solutions to real-life problems.

	Hours/week	No. of weeks	Total hours	Semester credits
Practical	**04**	**15**	**60**	**02**

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. To develop an appreciation of rural culture, life-style and wisdom amongst students
2. To learn about the status of various agricultural and development programmes
3. To understand causes for distress and poverty faced by vulnerable households and explore solutions for the same
4. To apply classroom knowledge of courses to field realities and thereby improve quality of learning

Course outcomes:

After successful completion of this course the student will be able to:

1. Gain an understanding of rural life, Indian culture & ethos and social realities
2. Develop a sense of empathy and bonds of mutuality with local community
3. Appreciate significant contributions of local communities to Indian society and economy
4. Learn to value the local knowledge and wisdom of the community
5. Identify opportunities for contributing to community's socio-economic improvements

COURSE CONTENT

COMMUNITY ENGAGEMENT PROJECT / FIELD PROJECT (ELC)		**Semester:**	**III**	**Course Code**	**CE – 310**
Teaching Scheme:		**Examination scheme**			
Practical's:	**4 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**50 Marks**

The course requires students to participate in any **TWO** field-based learning/projects as listed

below under the supervision of faculty. This will help educate local communities about new technological innovations as well as aware students about ways to harness local technology and knowledge. In this approach, students apply their knowledge and skills in a chosen community to improve the lives of people in that community. The activities may also be conducted other than working hours.

Recommended field-based activities (Tentative):

1. Interaction with Self Help Groups (SHGs) women members, and study of their functions and challenges; planning for their skill building and livelihood activities
2. Visit Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGS) project sites, interact with beneficiaries and interview functionaries at the work site
3. Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures
4. Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP)
5. Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization
6. Visit Rural Schools / mid-day meal centres, study academic and infrastructural resources and gaps
7. Participate in Gram Sabha meetings, and study community participation
8. Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
9. Visit to local Nagarpalika office and review schemes for urban informal workers and migrants
10. Attend Parent Teacher Association meetings, and interview school drop outs
11. Visit local Anganwadi Centre and observe the services being provided
12. Visit local NGOs, civil society organisations and interact with their staff and beneficiaries,
13. Organize awareness programmes, health camps, Disability camps and cleanliness camps
14. Aware / conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys and guiding solar powered village
15. Raise understanding of people’s impacts of climate change, building up community’s disaster preparedness
16. Organise orientation programmes for farmers regarding organic cultivation, rational use of

irrigation and fertilizers and promotion of traditional species of crops and plants

17. Formation of committees for common property resource management, village pond maintenance and fishing
18. Identifying the small business ideas for rural areas to make the people self-reliant.
19. Undertaking research projects in partnership with local community through community-based research methods
20. Social innovation projects with a social impact
21. Financial Literacy Awareness Programme
22. Digital Literacy Awareness Programme
23. Education Loan Awareness Programme
24. Entrepreneurship Awareness Programme
25. Awareness Programmes on Government Schemes
26. Products Market Awareness
27. Services Market Awareness
28. Consumer Awareness Programme
29. Accounting Awareness Programme for Farmers
30. Accounting Awareness Programme for Street Vendors etc.
31. Nutrition survey for mothers and children, and educate them about hygiene and nutrition.
32. Study / Survey / Field based Project on contributions / implications / influence / impact of Indian Knowledge System on Indian Society / Community / life / values / practices / principles / technology / development etc.

Students must conduct comprehensive studies on various challenges that they face in their chosen field. Every work relevant to the subject matter should be compiled and documented.

Students should keep separate fieldwork diary or maintain journal in order to record their fieldwork experiences i.e. reading, e- contents, tasks, planning and work hours have to be recorded in the diary. Detailed work records report on students' fieldwork experiences and activities to be submitted and should be presented.

Every student shall submit a report in the form of journal that may include, but not limited to, the following.

1. A map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village / community.

2. Videos and/or Geo-tagged photographs of events / activities conducted
3. Describe your analysis of rural household economy, its challenges and possible pathways to address them
4. How effectively are institutions functioning? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual).

Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving implementation of the programme for the community.

Guide lines for ICA:

Students must submit ICA in the form of journal. Faculty in charge will monitor and assess continuously with grade or mark each project on completion date declared for each of them. Assessments of students shall include review of their involvement and contributions to community engagement. It shall also include presentation of project findings as documented in the journal.

Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering

in

(Common for all)

(As per NEP 2020 Guidelines)

Faculty of Science and Technology



COURSE OUTLINE FOR OPEN ELECTIVE - I

For Affiliated Colleges

Semester – III

W.E.F. 2025 – 26

Open Elective – I

A Student can opt for any one subject out of available institute wide subjects defined in the following list as Open Elective provided, he/she has not taken that particular subject in his/her Programme core, Programme elective, Multidisciplinary Minor, other Open elective and Vocational and Skill Enhancement courses etc. throughout his / her four years of UG Engineering Programme. The student must opt a subject that is compulsorily from faculty other than that of the Major discipline.

Course Code	**Name of the Subject / Course**	**Faculty Offered by**	**Department Offered by**
Open Elective - I (w.e.f. 2025 - 26 at Semester - III, Second Year Engineering)			
OE – 307 A	Quantitative Reasoning and Problem Solving	Sci. & Tech.	Mathematics
OE – 307 B	Management Science	Comm. & Mgmt.	Management
OE – 307 C	Business Ethics & Professional Values	Comm. & Mgmt.	Management
OE – 307 D	Plant Nursery and Management	Sci. & Tech.	Botany
OE – 307 E	General Clinical Pathology	Sci. & Tech.	Biochemistry
OE – 307 F	Herbal Home Remedies	Sci. & Tech.	Botany
OE – 307 G	Psychology of Well-being	Humanities	Psychology
OE – 307 H	Fundamentals of Banking	Humanities	Economics

QUANTITATIVE REASONING AND PROBLEM SOLVING (Open Elective – I)

COURSE OUTLINE

Course Title:	**QUANTITATIVE REASONING & PROBLEM SOLVING**	**Short Title:**	**QRPS**	**Course Code:**	**OE - 307 A**

Course description:

The Quantitative Reasoning course is designed to develop a student's ability to understand, analyze, and apply mathematical concepts and reasoning techniques to solve real-world problems. The course emphasizes critical thinking and logical analysis, focusing on the interpretation and manipulation of quantitative data.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):Nil

Course objectives:

1. Use appropriate mathematical and statistical language in oral, written, and graphical forms.
2. Think critically about mathematical models for relationships between different quantities and use those models effectively and accurately to solve problems and reach sound conclusions about them.
3. Interpret and analyze various representations of data.

Course outcomes:

After successful completion of this course the student will be able to:

1. Perform arithmetic calculations on number system, HCF and LCM and age
2. Solve application problems involving Time, Distance, and Speed.
3. Calculate the time required to do the work and fill the cistern.
4. Calculate problems based on percentage, average and simple interest.
5. Analyze and interpret data using statistical techniques

COURSE CONTENT

QUANTITATIVE REASONING AND PROBLEM SOLVING		**Semester:**	**III**
Teaching Scheme:		**Examination Scheme:**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of EE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Number System: Fundamental Concepts, Tests of Divisibility, Factorial of number, Modulus of a number, Greatest integral Value, Multiplication by Short cut method, Division algorithm.

Highest Common Factor and Least Common Factor: Factors and Multiples, Factorization method, Division Method, HCF and LCM of fractions, HCF and LCM of decimal Fractions. Problems on Ages: Ratio Based Age Problems, Equation Solving Type Age Problems, Finding Ratio Between Ages.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Time and Distance: Unit Conversion Time and Distance Problems, Average Speed When Travelling To A Place And Returning, Problems Based On Changing Time And Changing Speed.

Problem on Trains: Important facts and Formulae, Time taken by train to pass pole/standing man / Signal post, relative Speed of trains/ bodies moving in same direction, cross time of trains/bodies moving in opposite direction, Cross time trains/ bodies moving in same direction with different speed, reaching time of two trains/ bodies start at the same time from point A and B towards each other destination.

Problem on Boat: Speed of downstream, Speed of upstream, Speed in still water, Rate of stream, Speed of the man in still water.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Time and Work: Calculate Time to Complete Work by 2 or More People, Equations Based Time and Work Problems, Efficiency Based Time and Work Problems, Calculate Time When Efficiency is Given in Percentage, Calculate Time When Workers Leave in Between, Share of Salary Based on Work.

Pipes and Cisterns: Important Facts and Formulae, Calculate Time Taken to Fill a Tank By 2 or More Pipes, Calculate Time Taken to Fill a Tank with Leakage, Equations Based Pipes and Cistern Problems, Calculate Time Taken When Pipes Are Opened for Different Periods, Calculate Number of Pipes.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Percentage: Concepts of percentage, Results on population, Result on depreciation, Salary Comparison percentage problems, Appreciation and depreciation based Percentage problems, Price and consumption based percentage problems

Average: Number Series Summation based Averages, Consecutive Even/Odd Type Problems, Distance and Speed based Averages.

Simple Interest: Important Fact and Formulae, Simple Interest Formula based Direct Problems, Compound Interest Formula based Direct Problems

Ratio and Proportion : Combined Ratio Based on Individual Ratios, Distributing any Quantity Based

on Ratios, Coins Based Ratio Problems, Mixtures & Replacement Based Ratio Problems		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Clocks: Finding angle between Minute and Hour Hands, Finding Time if angle is given, Correct Time on incorrect (Fast or Slow) Clocks. Calendar: Odd day, Leap year, Ordinary Year, Counting of Odd days, Day of the week related to odd days. Data Interpretation: Tabulation, Bar Graph, Pie Chart, Line graph, Problem on data Interpretation: Sum and Difference based, Average based questions, percentage-based questions.		
Text Books:		
1. Dr. R.S. Aggarwal "Quantitative Aptitude" S. Chand Publication, Revised Edition 2017		

MANAGEMENT SCIENCE (Open Elective – I)

COURSE OUTLINE

Course Title:	**MANAGEMENT SCIENCE**	**Short Title:**	**MS**	**Course Code:**	**OE – 307 B**

Course description:

This course provides students with a fundamental understanding of Management Science, covering key concepts such as decision-making, organizational structure, operations and process management, project management, and modern management practices. The course focuses on essential management functions, managerial skills, quality control techniques, inventory management, and project planning tools like PERT and CPM. It aims to develop students' analytical and problem-solving skills, preparing them for effective decision-making and managerial roles in various industries.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	**15**	**45**	**03**

Prerequisite course(s):Nil

Principles of Management, Quantitative Techniques for Management, Operations Management, Project Planning and Control and Business Analytics

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. To understand the fundamental principles and functions of management and their historical evolution.
2. To analyse organizational structures and evaluate their impact on business efficiency.
3. To apply quality management techniques and inventory control methods for process optimization.
4. To utilize network analysis techniques like PERT and CPM for project planning and management.
5. To implement modern management practices such as ERP, JIT, TQM, and Six Sigma for continuous improvement.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain core management concepts and their relevance in organizational success.
2. Evaluate and implement appropriate organizational structures based on business needs.
3. Apply inventory and quality management techniques to optimize business processes.
4. Demonstrate the use of project management tools for effective planning and execution.
5. Implement modern management methodologies such as Kaizen, Kanban, and Lean Manufacturing to improve organizational performance.

COURSE CONTENT			
MANAGEMENT SCIENCE		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fundamentals of Management

Definitions, Nature, Importance, and Functions of Management

Historical Perspectives: Evolution of Management Thought

Levels of Management and their Functions

Decision-Making Types & Process

Managerial Skills and Roles (Mintzberg's)

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Organization and Structure

Concepts and Principles of Organization

Formal and Informal Organization, Authority, Responsibility, Delegation

Types of Organizational Structures: Line, Line and Staff, Matrix, and Team Structures

Departmentation: Need, Importance, and Bases of Departmentation

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Operations and Process Management

Fundamentals of Work Study: Time and Motion Study Techniques

Quality Management: Tools and Techniques (P-Chart, R-Chart, C-Chart)

Inventory and Material Management:

Importance of Inventory Control

Economic Order Quantity (EOQ) Calculation

ABC Analysis and its Variants (HML, SDE, VED, FSN)

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Project Management

Introduction to Project Management: Objectives and Importance

Network Analysis: Concepts and Applications

PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method): Comparison and Implementation

Project Optimization: Cost-Time Trade-Off and Crashing Techniques

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Modern Management Practices

Materials Requirement Planning (MRP) and Enterprise Resource Planning (ERP)

Just-In-Time (JIT) and Lean Manufacturing

Total Quality Management (TQM): Principles and Implementation

Six Sigma: Concepts and DMAIC Process

Japanese Management Practices: Kaizen, Kanban, and 5S

Text Books:

1. Essentials of Management by Harold Koontz & Heinz Weihrich, 6th Edition, Tata McGraw-Hill (2005)

Reference Books:

1. Koontz & Weihrich: Essentials of Management, 6/e, TMII, 2005
2. Kanishka Bedi: Production and Operations Management, Oxford University Press, 2004
3. Samuel C. Certo: Modern Management, Pearson Education, 2005
4. Mahajan, M. (2015). Industrial engineering and production management. Dhanpat Rai & Co. (P) Limited.

NPTEL Links:

1. Principles of Management by Prof. Usha Linka
   https://archive.nptel.ac.in/courses/110/107/110107150/
2. Production and Operation Management by Prof. Rajat Agrawal
   https://archive.nptel.ac.in/courses/110/107/110107141/
3. Economic Order Quantity by Prof. Puran Singh
   https://www.youtube.com/watch?v=_h4i9C47rT8
4. Total Quality Management by Prof. Raghunandan Sengupta
   https://archive.nptel.ac.in/courses/110/104/110104080/

BUSINESS ETHICS & PROFESSIONAL VALUES (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**BUSINESS ETHICS & PROFESSIONAL VALUES**	**Short Title:**	**BE&PV**	**Course Code:**	**OE – 307 C**

Course description:

This course provides students with a fundamental understanding of business ethics and professional values, focusing on ethical decision-making, corporate governance, workplace ethics, and corporate social responsibility (CSR). It explores ethical leadership, environmental sustainability, and the ethical challenges posed by emerging technologies.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):Nil

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. Understand the principles and significance of business ethics in organizational success.
2. Analyse ethical theories and decision-making models in corporate environments.
3. Evaluate corporate governance, ethical leadership, and workplace ethics.
4. Explore ethical challenges in technology, globalization, and sustainability.
5. Develop a strong foundation in professional values and responsible business conduct.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply ethical principles and decision-making frameworks in business scenarios.
2. Assess the role of corporate governance and ethical leadership in business success.
3. Analyse workplace ethics and strategies for ethical corporate culture.
4. Evaluate ethical considerations in technology, cyber security, and sustainability.
5. Demonstrate professional values such as integrity, accountability, and transparency in decision-making.

COURSE CONTENT

BUSINESS ETHICS & PROFESSIONAL VALUES		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12
Fundamentals of Business Ethics		
Definition, significance, and principles of business ethics Ethical theories: Utilitarianism, Deontology, Virtue Ethics Ethical decision-making models: Consequentialist, Non-consequentialist and Hybrid Approaches Role and importance of ethics in achieving organizational goals Corporate Governance and Ethical Business Practices Ethical dimensions of corporate social responsibility (CSR)		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Ethical Leadership and Workplace Practices		
Key aspects: Workplace ethics, confidentiality, and transparency Ethical leadership: Traits, decision-making, and influence on organizational culture Technology ethics: Privacy, cybersecurity, and AI-related challenges Addressing dilemmas: Whistleblowing, conflicts of interest, and ethical challenges Diversity, equity, and inclusion (DEI) in ethical decision-making Corporate fraud and unethical business practices: Causes, consequences and Preventive measures		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Emerging Ethical Challenges and Trends		
Ethical considerations in disruptive technologies: AI, blockchain, IoT, and robotics Intellectual property rights (IPR): Significance and ethical dimensions of innovation Ethical challenges in globalization: Cultural relativism and navigating cross-border practices Future trends: Sustainable leadership, stakeholder capitalism, and Industry 4.0 Environmental ethics in business: Carbon footprint reduction, sustainable resource management and corporate environmental responsibility Cyber security and ethical hacking: Digital ethics, protection against cybercrimes, ethical dilemmas in surveillance, and hacking ethics		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Environmental and Sustainability Ethics		
Organizational responsibilities for health, safety, and the environment Green engineering: Sustainable designs and renewable technologies Case studies: Lessons from environmental disasters (e.g., Bhopal Gas Tragedy, Exxon Valdez oil spill) Regulatory frameworks: Environmental laws, compliance, and ethical practices Climate change and corporate responsibility: Strategies for sustainable business operations Role of businesses in achieving Sustainable Development Goals (SDGs)		

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Professional Values

Definition and relevance of professional values

Core values: Honesty, integrity, accountability, transparency, and respect

Workplace ethics: Building an ethical culture and promoting positive work environments

Professional codes of conduct: ASME, ASCE, IEEE, IETE

Business etiquette and ethical decision-making in professional interactions

Role of mentorship and leadership in cultivating professional values

Text Books:

1. "Business ethics: Concepts and cases (9th ed.)" by Velasquez, M. G. (2020) Pearson.

Reference Books:

1. Crane, A., Matten, D., Glozer, S., & Spence, L. J. (2019). Business ethics: Managing corporate citizenship and sustainability in the age of globalization (5th ed.). Oxford University Press.
2. Fernando, A. C. (2019). Business ethics: An Indian perspective (4th ed.). Pearson Education India.
3. Saha, B. (2010). Environmental ethics: A practical approach. Aadi Publications.
4. Johnson, D. G., & Wetmore, J. M. (2008). Technology and society: Building our sociotechnical future. MIT Press.

NPTEL Links:

1. Business Ethics by Prof Susmita Mukhopadhyay
   https://archive.nptel.ac.in/courses/110/105/110105079/
2. Intellectual property rights By Dr. K. D. Raju
   https://archive.nptel.ac.in/courses/110/105/110105139/
3. Ethics in Engineering Practice by Prof Susmita Mukhopadhyay
   https://archive.nptel.ac.in/courses/110/105/110105097/
4. Introduction to Industry 4 0 and Industrial Internet of Things by a Prof. Sudip Misra

PLANT NURSERY AND MANAGEMENT (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**PLANT NURSERY AND MANAGEMENT**	**Short Title:**	**PNM**	**Course Code:**	**OE – 307 D**

Course description:

This course is designed to provide students with an in-depth understanding of the processes, practices, and techniques involved in the establishment and management of plant nurseries. It covers various aspects of plant production, from seedling propagation to the management of nursery operations. Students will gain practical knowledge in selecting plant species, propagating plants, maintaining nursery health, and understanding the financial and operational considerations in managing a nursery.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s): Nil

Course objectives:

1. To provide knowledge about basic concepts and principles of nursery techniques.
2. To impart basic and technical knowledge on nursery management for strengthening of horticulture sector.
3. To study the disease and pest controlling nursery with practical experience.
4. To help students to study marketing and management relating to nursery.
5. To help students to manage nurseries and propagate healthy plants on a commercial scale.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the importance of a plant nursery and basic infrastructure to establish it.
2. Explain the basic material, tools and techniques required for nursery.
3. Demonstrate expertise related to various practices in a nursery.
4. Comprehensive knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.
5. To know green house and playhouse technology.

COURSE CONTENT

PLANT NURSERY AND MANAGEMENT		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Plant nursery:

Introduction, definition and importance. Types of nurseries, Temporary (Features, Advantages and disadvantages).Permanent (Features, Advantages and disadvantages.) Ornamental, Vegetable, Fruit plant, Forest plant, Open field and High-tech nurseries. Selection of place, lay out and components of a good nursery. Important role of nursery in horticulture development.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Nursery Basic requirement and setup:

Nursery beds–types and precautions to be taken during preparation. Growing media, nursery tools and implements, and containers in brief. Soil and seed treatments sowing of seeds and planting material used for nursery.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Plant Propagation Technique:

Introduction, Sexual propagation (Advantages and dis-advantages) Cutting (Root, Stem and leaf cutting) Layering (Simple and Air layering) (Gootee) Budding (T and Patch budding)Grafting (Whip and tongue grafting). Green house and Polyhouse Types and importance.

Unit-IV:	No. of Lectures: 09 Hours	Marks: 12

Nursery Management practices:

Potting and repotting, application of manures and fertilizers. Plant bio-regulators and growth retardants, Water quality and management. Common diseases, pests, care and management of nursery plants. Seasonal activities and routine operations in a nursery. Common possible errors in nursery activity. Bureau of Indian Standards (BIS-2008) related to nursery. Economics of nursery development, pricing and record maintenance. Packing, transport, Branding and marketing of nursery plants. Entrepreneurship development through nursery.

Unit-V:	No. of Lectures: 09 Hours	Marks: 12

Vertical farming and Hydroponics:

Vertical Farming: Introduction, scope and importance. Plants suitable for vertical farming. Advantages of vertical farming. Hydroponics: Introduction, scope and importance. Basic concepts and designs, Importance of light, temperature and humidity. Nutrient film technique (NFT) Advantages and Plants suitable for hydroponics.

Text Books:

1. "Plant Nursery Management: Principles and Practices, Central Arid Zone Research Institute" by Ratha Krishnan, P. Kalia Rajwant K.Tewari, J.C., Roy M.M., (2014).

Reference Books:

1. Bose, T.K. Sanyal, Dand Sandhu, M.L. (1998) Propagation of Horticultural crops. Naya Prakash Publishers, Kolkatta.
2. K.K. Nanda and V.K. Kochhar (1985). Vegetative propagation of plants. Kalyani

Publisher-NewDelhi-Ludhiana.

3. Kunte, Y.N.,Kawthalkar, M.P.andYawalkar,K.S.(2005).Principles of Horticulture and Fruit Growing. Agri-Horticultural Publishing House, Nagpur.
4. Rahudkar W.B., Bhujbal B.G.,Madhuri Sonawane, Hemraj Rajput ,(2010), CMOU, Text book Publication No. AGR 227Horticulture Nursery Management.
5. Randhawa G.S., A. Mukhopadhyay (2001). Floriculture in India. Book published by Allied Publishers Limited, New Delhi

NPTEL Links:

1. Basics of Crop Breeding and Plant Biotechnology (https://onlinecourses.nptel.ac.in/noc25_ag01/preview)
2. Plant Developmental Biology By Prof. Shri Ram Yadav | IIT Roorkee (Plant Developmental Biology - Course (nptel.ac.in))

GENERAL CLINICAL PATHOLOGY (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**GENERAL CLINICAL PATHOLOGY**	**Short Title:**	**GCP**	**Course Code:**	**OE - 307 E**

Clinical pathology is the second major subdivision of the discipline of pathology after anatomic pathology. It is concerned with laboratory investigations for screening, diagnosis, and overall management of diseases by analysis of blood, urine, body fluids, and other specimens. The specialties included under the discipline of clinical pathology are clinical chemistry, hematology, blood banking, medical microbiology, cytogenetics and molecular genetics.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Course objectives:

The objective of this course is to:

1. To study the basic principles of laboratory medicine.
2. Laboratory examination of various body fluids for screening and diagnosis of diseases.
3. To study the tests required for assessing various organ functions.
4. Laboratory examination of formed elements of blood and to study different tests involved in the diagnosis of disorders of blood.
5. To study blood group systems, blood transfusion, screening tests for infections transmissible by transfusion and its adverse effects.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain the significance of clinical pathology in screening and diagnosis of diseases.
2. Describe the role of laboratory in examination of various body fluids, metabolic disorders, gastric anatomy, pregnancy and reproductive system disorders.
3. Explain the structure and function of different organs present in clinical pathology setting and enlist the classification of tests required for evaluating those respective organ functions.
4. Enlist the components of blood and describe the role of several formed elements of blood in clinical pathology.
5. Describe the blood group systems, types of blood donors, screening and identification of antibody.

COURSE CONTENT

GENRAL CLINICAL PATHOLOGY		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**

	Duration of ESE:	**03 hours**
	Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Laboratory tests for organ function and examination of body fluids:

Basic principles of laboratory medicine, Examination of Urine, Kidney Function Tests, Laboratory test in Diabetes Mellitus, Liver Function test, Laboratory test in disorders of lipids, Biochemical Cardiac Markers, Examination of Cerebrospinal fluid, Examination of Synovial Fluid, Examination of Sputum.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Gastric system and reproductive system analysis:

Examination of Feces, Gastric Analysis, est for Malabsorption and Pancreatic function test, Thyroid function test, Laboratory tests in pregnancy, Infertility, Semen Analysis, Pyrexia of unknown origin.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Methods for estimation of Blood cell count:

Haematopoiesis, Collection of blood, Automated complete blood cell count, Estimation of Haemoglobin, Packed cell volume, Total leucocyte count, Reticulocyte count, Platelet count, Blood smear, Red cell indices, Erythrocyte sedimentation rate, Examination of bone marrow.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Laboratory test for disorders of Blood:

Malignancy, Laboratory test in bleeding disorders, Laboratory test in Thrombophilia, Laboratory Hematology of infectious disease, Laboratory tests in anaemia, Laboratory test in Hematological test in porphyrias.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Blood group systems and Transfusion of blood:

Blood Group systems, Blood grouping, Collection of donor blood, processing and storage, Screening tests for infections transmissible by transfusion, Antibody Screening and Identification, Compatibility Test, Whole blood, blood components and blood derivatives, Adverse effects of Transfusion.

Text Books:

1. “Essentials of Clinical Pathology" by Shirish M. Kawthalkar, JP Medical Ltd, 2018.

Reference Books:

1. Clinical Pathology, Hematology & Blood banking, 3rd Edition, Nanda Maheshwari.
2. Clinical Pathology Interpretations, A.H.Nagi, Fourth Edition.
3. Essential textbook of Clinical Pathology with Practicals, Tapeshwar yadav & Asheshwar Yadav.
4. Consise text in Clinical pathology, Hematology & Blood banking, Surabhi Bansal, AITBS Publisher.
5. Laboratory Manual of clinical pathology and hematology, Santosh Kumar Mondal.

6. A consise textbook of Clinical Pathology, Hematology & Blood banking, Rakesh Joshi.

HERBAL HOME REMEDIES (Open Elective – I)

COURSE OUTLINE

Course Title:	**HERBAL HOME REMEDIES**	**Short Title:**	**HHR**	**Course Code:**	**OE – 307 F**

The herbal home remedies course is designed to introduce individuals to the power of natural, plant-based remedies that can be used for common ailments and overall health maintenance. Participants will learn the principles of herbal medicine, understand the therapeutic properties of different herbs, and explore how to incorporate them into daily life through simple, safe, and effective home remedies. The course will cover a wide range of herbs and their uses in treating various conditions, including digestive issues, skin problems, stress, sleep disturbances, and immune system support. By the end of the course, students will have the knowledge to prepare herbal teas, tinctures, salves, and other remedies.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Course objectives:

The objective of this course is to:

1. Understand the basics of herbal medicine and its history in various cultures.
2. Familiarize yourself with common medicinal herbs and their healing properties.
3. Gain hands-on experience in making teas, tinctures, syrups, salves, and poultices.
4. Discover herbal solutions for everyday health concerns like colds, headaches, digestive problems, and skin issues.
5. Learn how to incorporate herbs into your diet, beauty routines, and wellness practices.

Course outcomes:

After successful completion of this course the student will be able to:

1. Identify and classify common herbs and their medicinal uses.
2. Create their own herbal remedies such as teas, tinctures, and oils tailored to specific health needs.
3. Apply natural remedies to improve personal health and wellness in a safe and sustainable way.
4. Understand how to work with herbs to support emotional and physical balance in the body.
5. Integrate herbs into daily routines to enhance lifestyle, nutrition, and overall well-being.

COURSE CONTENT

HERBAL HOME REMEDIES		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**

	Duration of ESE:	**03 hours**
	Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Herbal Medicine:

Definition of herb, herbal medicine, Source of Herbs, Basic introduction of Ayurveda, Siddha, Unani and Homeopathy, Introduction of in cultivation of medicinal plants, Leaf, bark, root, seed, flowers, fruits & gums.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Herbal Identification and Properties:

Basic home remedies for general problem: Cold and Cough, Fever, Acidity, Itching, Constipation, Headache, Toothache, Vomiting.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Preparing Herbal Remedies:

Source of minerals, vitamins, protein, Source of home spices & plant: honey, ashwagandha tulsi, shilagit, bhel, adulsa, pipal, black pepper , caraway seeds , cardamom seed powder , cayenne , celery seed , chives , chile peppers , Korintje cinnamon , Vietnamese cinnamon , cloves , cumin , dill seed , dill weed , garlic , gumbo filé , lemon , mace , marjoram , nutmeg , onion , oregano (Mediterranean).

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Herbal Remedies for Common Ailments:

Herbal compound for oral care, skin care, sun care, hair care, decorative cosmetics, body care and perfumes.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Integrating Herbal Remedies into Daily Life:

Preparation of Ayurvedic formulations viz powder, Ghutika, Churna and Bhasma.

Text Books:

1. “Textbook of Pharmacognosy” by Trease & Evans.

Reference Books:

1. Pharmacognosy & Phytochemistry by V. D. Rangari.
2. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy).
3. “Pharmacognosy” by Kokate, Purohit and Gokhale.

PSYCHOLOGY OF WELL-BEING (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**PSYCHOLOGY OF WELL-BEING**	**Short Title:**	**POWB**	**Course Code:**	**OE – 307 G**

The Psychology of Well-Being course explores the psychological factors that contribute to human flourishing, happiness, and life satisfaction. This course delves into the scientific study of well-being, examining how positive emotions, healthy relationships, resilience, and personal growth influence mental and physical health. Students will explore theories and research from positive psychology, focusing on practical strategies to enhance personal well-being and cultivate a meaningful life. By understanding the psychological principles behind well-being, students will be better equipped to foster positive mental health both in themselves and in others.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s):Nil

Course objectives:

The objective of this course is to:

1. The psychological and physiological benefits associated with experiencing positive emotions, such as improved resilience, mental health, and social connections.
2. The mindfulness and its components, including present-moment awareness, non- judgmental acceptance, and compassion.
3. The different strategies for developing and enhancing emotional intelligence skills, including mindfulness practices, self-reflection exercises, and social skill-building activities.
4. The important concepts of well-being like conflict resolution, reconciliation, and stress management
5. Include mindfulness practices, self-reflection exercises, and social skill-building activities.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the positive emotion and well-being, including the ability to define and differentiate these concepts from other affective states and mental health constructs.
2. Demonstrate an understanding of mindfulness principles and techniques, including the ability to define mindfulness and its components such as present-moment awareness, non-judgmental acceptance, and compassion.
3. Develop strategies for enhancing emotional intelligence competencies, including

mindfulness practices, self-reflection exercises, and social skill-building activities.

4. Collaborate with peers to explore the application of gratitude and forgiveness principles in real-world scenarios, such as conflict resolution, reconciliation, and stress management, demonstrating the ability to work effectively with others and apply learned concepts in practical settings.
5. Developing personal tools and strategies for enhancing individual well-being.

COURSE CONTENT

PSYCHOLOGY OF WELL-BEING		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Positive emotion and well-being :

Positive Emotions: Meaning of Positive Emotions, Identifying Positive Emotions, Benefits of Positive Emotions Barbara Fredrickson's Broaden and Build Theory of Positive Emotions Positive Emotions and Health Resources: Physical, Psychological and Social Resources. Positive Emotions and Well-being: Happiness and Positive Behavior, Positive Emotion and Success, Positive Emotion and Flourishing (PERMA Model) Cultivating Positive Emotions: Flow Experiences, savoring.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Mindfulness and well-being :

Mindfulness: Meaning, Mindfulness as an Antidote for Mindlessness, Mindfulness as Present-centered, Awareness and Attention Mindfulness Meditation, Attributes of Mindful Awareness- Non-Judging, Patience, Beginner Mind, Trust, Non-Striving, Acceptance, Letting go. Benefits of Mindfulness, Mindfulness and Mental Health, Living with Mindfulness: Being Mindfulness of Emotion, Being Mindfulness of Eating, Being Mindfulness of Exercise, Mindfulness Breathing and sitting as a Meditation Mindfulness and Happiness.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Emotional intelligence:

Emotional Intelligence, Meaning, Nature and Definition Theories of EI, Peter Salovey and John D Mayre, Danial Golman, Bar-On Emotional Intelligence and Happiness Ways That Emotionally Intelligent People Choose for Happiness Factors - Emotional Intelligence Be Increased, Manage another Person's Emotions.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12
Gratitude and forgiveness :		
Gratitude: Meaning and Concept, Characteristics of Gratitude People, Gratitude Physical and Mental Health, Gratitude and Happiness, Ways to Practice Gratitude Forgiveness Meaning, Definition, Importance and Types, Benefits of Forgiveness, Forgiveness is the key of Happiness.		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Happiness and the Facts of Life :		
Happiness Across the Life-Span - Focus on Research: Happiness and Where we Live - Stability in Well-Being Despite Life Changes - Temperament and Subjective Well-Being - Frequency, Intensity and Balance of Positive and - Negative Emotions - Measurement and Definitional Issues -The Shifting Basis of Life Satisfaction - Gender and Happiness - Gender differences in Emotional Experience - Negative Emotions - Positive Moods and Behaviors - Explaining the Paradox of Gender Other Facts of Life - Physical and Mental Health ,Work and Unemployment , Intelligence and Education - Religion - Race, Ethnicity and Stigma.		
Text Books:		
1. "The Role of Positive Emotions in Positive Psychology: The Broadenand-Build Theory of Positive Emotions" by Fredrickson, B. L. (2001) American Psychologist, 56, 218-226.		
Reference Books:		
1. Steve B. & Marie, C. (2015). Positive Psychology. Pearson Education. 2. Snyder C.R., Lopez S.J., Pedrotti J.T. (2011) Positive Psychology. Sage Publication.		
NPTEL Links: 1. Introduction to Psychology By Prof. Braj Bhushan, IIT Kanpur https://onlinecourses.nptel.ac.in/noc21_hs49/preview		

FUNDAMENTALS OF BANKING (Open Elective – I)					
COURSE OUTLINE					
Course Title:	**FUNDAMENTALS OF BANKING**	**Short Title:**	**FOB**	**Course Code:**	**OE – 307 H**

This course provides a fundamental understanding of banking concepts, types of banks, negotiable instruments, banking operations, and remittance methods. It covers essential topics like account management, banking regulations, and digital banking services, equipping students with foundational knowledge for careers in banking and finance.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Course objectives:

The objective of this course is to:

1. Explain the basic concepts, evolution, and significance of banking.
2. Provide knowledge of different types of bank accounts and their operations.
3. Introduce negotiable instruments and their role in banking transactions.
4. Familiarize students with endorsements, remittances, and digital banking methods.
5. Develop an understanding of banking regulations, customer protection, and ethical banking practices.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the fundamental concepts and functions of banking.
2. Identify different types of bank accounts, cooperative banking structures, and their significance.
3. Analyze the characteristics and legal aspects of negotiable instruments and endorsements.
4. Evaluate different means of remittances and their role in modern banking.
5. Apply knowledge of banking regulations, digital banking, and financial security measures.

COURSE CONTENT

FUNDAMENTALS OF BANKING		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fundamentals of Banking

Meaning and definition of banking

Evolution of banking in the world and in India

Importance of banking in the Indian economy

Types of banks – Commercial Banks, Cooperative Banks, Development Banks, and Central Bank

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Banking Operations and Account Management

Types of bank accounts – Savings, Current, Fixed Deposit, Recurring Deposit, Non-Resident Accounts

Procedure for opening, operating, and closing accounts

KYC norms and customer due diligence

Role of banks in financial inclusion

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Negotiable Instruments and Endorsements

Meaning, characteristics, and types of negotiable instruments – Promissory Notes, Bills of Exchange, Cheques

Types of cheques – Bearer, Order, Crossed (General & Special)

Endorsements – Definition, characteristics, types (Blank, Special, Partial, Restrictive, Conditional, Facultative)

Rights and liabilities of parties to negotiable instruments

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Remittance Services and Digital Banking

Different means of remittances – Demand Drafts, Letters of Credit

Credit Cards, Debit Cards, ATMs – Advantages and Disadvantages

MICR cheques and their significance

Introduction to digital banking – NEFT, RTGS, UPI, Mobile Banking

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Banking Regulations and Ethical Practices

Role of regulatory authorities – RBI, SEBI, and their functions in banking

Consumer protection in banking – Banking Ombudsman Scheme

Common banking frauds and security measures

Ethical banking practices and financial literacy

Text Books:

1. "Basics of Banking and Finance" by K.M. Bhattacharya & O.P. Agrawal, Himalaya Publishing House.

Reference Books:

1. Elements Banking and Insurance – B. S. Shah Publication, Ahmadabad
2. Elements of Banking and Insurance – New Popular Publication, Surat
3. Banking Theory and Practice, Prem Kumar Srivastava, Himalaya Publishing House.

4. “Fundamentals of Banking Theory and Practice” by A.K. Basu.

NPTEL Links:

1. Management of Commercial Banking by Prof. Jitendra Mahakud, IIT Kharagpur
   https://nptel.ac.in/courses/110105143

Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering

in

Civil

(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

COURSE OUTLINE FOR
For Affiliated Colleges
Semester – IV
W.E.F. 2025 – 26

FLUID MECHANICS (PCC)					
COURSE OUTLINE					
Course Title:	**FLUID MECHANICS**	**Short Title:**	**FM**	**Course Code: Theory**	**CE-401**

Course description: This course is introduced in Civil engineering to develop the concept of fluid properties, fluid statics and dynamics.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The general objective of course is to develop the concept of fluid mechanics (behave) and its application. Civil engineering mostly related with water. This general objective is classified in specific objectives as follows:

1. Concept of Fluid and Fluid Properties.
2. Behave of fluid in static and dynamic condition.
3. Measurement of pressure.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply the knowledge of mathematics and science to develop, engineering fundamental concept of water behavior in Civil Engineering structure.
2. Understand the concept of problem analysis in different types of flow.
3. Analyze societal, health, safety, legal and cultural issues and the consequent responsibilities as a professional engineering practice in the field of fluid (water).
4. Evaluate effectively on complex engineering activities with the engineering community and with society at large in concern with fluid properties and its engineering application.
5. Create a need of lifelong learning in fluid mechanics and its application in Civil engineering.

COURSE CONTENT

FLUID MECHANICS		**Semester:**	**IV**	**Course Code**	**CE – 401**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**

	Internal Sessional Exam (ISE) CA:	**40 marks**
Unit–I:	**No. of Lectures: 09 Hours**	**Marks:** 12

Basic Concepts of Fluid, scope and applications of fluid mechanics; Properties of fluid such as Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility, Classification of Fluids.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fluid Statics - Fluid Pressure and its measurement

Pascals law, Hydrostatic law, Pressure Measurement-Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers, Pressure gauges Hydrostatic forces on surfaces- horizontal, vertical and inclined surfaces.

Introduction to Buoyancy and stability of floating bodies only. (No mathematical treatment)

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fluid Kinematics-

Classification of fluid flow: Steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Types of flow patterns-Stream line, path line, streak line and stream tube; stream function, velocity potential function. One and three – dimensional continuity equations in Cartesian coordinates.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fluid Dynamics- forces acting on fluid in motion; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter and pitot tube;

Dimensional Analysis and Dynamic Similitude -Dimensional Homogeneity ,Methods of Dimensional Analysis -Buckingham's π-theorem, Dimensionless Numbers and Their Significance - Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Laminar Flow- Laminar flow through pipes – Hagen-Poiseuilli's equation, Stoke's law, Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Turbulence phenomenon, scale and intensity Causes of turbulence Reynolds stresses, Prandtl's mixing length theory, universal velocity distribution equation (No derivation of velocity distribution equation), Hydrodynamically smooth and rough boundaries. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

Flow through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, and siphon.

Text Books:

1. A Textbook of Fluid Mechanics and Hydraulic Machine by Dr. R K. Bansal, Laxmi Publication.

Reference Books:

1. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
3. Fluid Mechanics by Dr. A. K. Jain, Khanna Publishers, Delhi
4. A Textbook of Fluid Mechanics by P.V.Shrotri, Nirali Publication.

NPTEL Links:

1. Introduction to Fluid Mechanics - Course By Prof. Suman Chakraborty , IIT Kharagpur
2. Fluid Mechanics - Course by Prof. Subashisa Dutta ,IIT Guwahati
3. NPTEL :: Civil Engineering - NOC:Fluid Mechanics by Prof.Subhasiha Datta, IIT, Guwahati.

FLUID MECHANICS LAB (PCC)					
LAB COURSE CONTENT					
FLUID MECHANICS LAB		**Semester:**	**III**	**Course Code**	**CE – 402**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment**		**25 Marks**	

		(ICA) CA:	
		End Semester Exam (ESE) UA:	**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**	
Concerned faculty member should suitably frame **SIX** laboratory assignments from the following list. **LIST OF PRACTICAL**- Any six experiments should be performed. (i) Measurement of viscosity (ii) Study of Pressure Measuring Devices (iii) Stability of Floating Body (iv) Reynolds Experiment (v) Verification of Bernoulli's Theorem (vi) Venturimeter (vii) Coefficient of Orifice (viii) Impacts of jets			
Guide lines for ICA:			
Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.			
Guide lines for ESE:			
ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.			

SOLID MECHANICS (PCC)					
COURSE OUTLINE					
Course Title:	**SOLID MECHANICS**	**Short Title:**	**SM**	**Course Code: Theory**	**CE - 403**

Course description: This course is further extension of engineering mechanics. This course develops the concept of various stresses and strains develop in the various members of civil engineering structure due to application of loads in different conditions, directions and supports.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Understand the concept various simple stresses and strains.
2. Understand the concept flexural or bending stress due to load on beam.
3. Understand the concept shear stress distribution along cross section of beam.
4. Understand the concept of uniform torsional stresses developed due to twisting of shaft.
5. Understand the concept of shear force and bending moment diagram to study the stresses developed in members of civil engineering structure.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the concept of axial simple stresses and strains and their relation.
2. Apply the knowledge of shear force diagram, bending moment diagram and analyze statically determinate structure (Member).
3. Evaluate a different stresses develop in the members of civil engineering structures due to application of various loads.
4. Develop the concept of simple bending theory.
5. Construct lifelong learning about stresses and strains develop in members of civil engineering structures from design consideration.

COURSE CONTENT				
SOLID MECHANICS	**Semester:**	**IV**	**Course Code**	**CE – 403**
Teaching Scheme:	**Examination scheme**			

Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Simple Stresses and Strains:

Concept of simple stress and strain, shear stress in uniform and composite section,

Hooke's law, and stress – strain relation for axially loaded member,

Concept of temperature stresses, Derivation on Temperature Stresses, Numerical on Temperature Stresses.

Poisson's ratio, volumetric strain, elastic constants (E,G and K) and relations between them.

Unit–II:	**No. of Lectures:** 09 Hours	**Marks:** 12

Bending moment and Shear Force Diagrams-

Analysis of shear force and bending moment and its distribution diagram for standard cases. (Simply supported beam with uniformly distributed load on entire span, point load at center, Cantilever beam with uniformly distributed load on entire span, point load at free end, couple at free end).

Analysis of shear force and bending moment at different section of cantilevers, simply supported beams and overhang beam with point load, uniformly distributed load and couple and its distribution diagrams.

Concept of sagging, hogging bending moment, point of contraflexure and maximum bending moment.

Construction of loading diagram from bending moment diagram and shear force diagram.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Strain Energy and impact loading:

Concept of strain energy, strain energy stored due to gradual, sudden and impact load.

Flexural or Bending Stresses:

Concept of theory of simple bending, assumptions, derivation of pure bending equation, section modulus.

Determination of bending stresses along the cross section of rectangular, circular, T, and I sections for the beam mentioned in Unit II of this subject syllabus.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Shear Stresses:

Concept of theory of shear stresses, assumptions, derivation of shear stress equation.

Determination of shear stresses along the cross section of rectangular, circular, T, and I sections for the beam mentioned in Unit II of this subject syllabus.

Torsion:

Concept of theory of pure torsion and its assumptions and derivation, torsional moment of resistance, power transmitted by shafts, torsional rigidity.

Determination of shear stresses in shafts due to torsion for hollow or solid cross-sections of shaft.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Axially loaded columns:

Concept of buckling of column, Euler's theory of long columns, assumptions, and derivation. Limitations of Euler's formula. Concept of various end conditions of column and its effect on equivalent length. Concept of Rankine's formula.

Direct & bending stresses

Concept of direct and bending stresses due to eccentric loading. Middle third rule, core of section.

Text Books:

1. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India

Reference Books:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall
3.Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of

Solids. 2nd ed. New York, NY: McGraw Hill.

4. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH.

5. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

Strength of Materials by S Ramamrutham, Dhanpat Rai Publications

NPTEL Links:

1. NPTEL :: Mechanical Engineering - NOC:Engineering Mechanics by K. Ramesh, IIT Madras
2. https://archive.nptel.ac.in/courses/105/104/105104160/ by Priyanka Ghosh, IIT Kanpur

SOLID MECHANICS LAB (PCC)					
LAB COURSE CONTENT					
SOLID MECHANICS LAB		**Semester:**	**IV**	**Course Code**	**CE – 404**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

Concerned faculty member should suitably frame **TWO** laboratory assignments from the following list.

LIST OF PRACTICAL: Any two experiments should be performed

1. Tests on timber: bending strength, moisture content.
2. Tensile strength of mild steel.
3. Izod and Charpy test on metal.

ASSIGNEMENT :

Any **Five** assignment

At least one assignment from each unit on numerical assigned by concern faculty member.

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the

journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.
Guide lines for ESE:
ESE will be based on practical, assignment submitted by the student in the form of journal. Evaluation will be based on oral exam, paper work and performance in the ESE.

CONCRETE TECHNOLOGY LAB (PCC)

COURSE OUTLINE

Course Title:	CONCRETE TECHNOLOGY LAB	Short Title:	CT	Course Code: Theory	CE - 405

Course description: Engineering is an art of utilizing forces and materials for specific requirements. It requires selection of material for a particular task. Consequently it is necessary for an engineer to know the properties of material, particularly the construction material. This course suffices that aspect. It includes properties of various materials used in civil engineering construction like cement, sand, aggregate and many such materials. The syllabus describes their basic civil engineering properties and their applications in civil engineering. The course also describes in detail about the concrete which is a derived material.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**01**	**15**	**15**	**02**
Practical	**02**	**15**	**30**	

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Understand the IS code required for different material testing procedure.
2. Understand specified limits as per IS code and its necessity for different materials and application.
3. Understand the procedure, by conducting the practical in laboratories.
4. Understand the necessary care and precaution during the lab work and its implication on site.
5. Understand the concept of effective and efficient use of material on site.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand and remember the relevant IS codes required for various test on concrete.
2. Apply knowledge from IS code in conducting the practical in laboratory on fresh and hardened concrete.

3. Analyze the different properties of fresh and hardened as per IS code procedure.
4. Evaluate the suitability of construction materials for different application in concrete.
5. Create an idea about design a concrete mix with different proportion.

COURSE CONTENT

CONCRETE TECHNOLOGY LAB		**Semester:**	**IV**	**Course Code**	**CE – 405**
Teaching Scheme:		**Examination scheme**			
Lectures:	**1 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
Practical :	**2 hours/ week**	**End Semester Exam (ESE)**			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			
----	**No. of Lectures: 14 Hours**			**----**	

Cement: - history, Manufacture of cement, raw materials used in cement manufacturing, ingredients of cement, hydration process of cement, compounds in cement, Types of cement, properties and testing of cement, storage of cement

Aggregates and testing of aggregates, coarse and fine aggregates. Concept and importance of shape, size, strength and their influence on concrete properties. Recycled aggregates: their uses in concrete. Water: role of water, water quality for concrete, Admixtures in concrete.

Fresh Concrete, Workability**,** factors affecting workability, determination of workability.

process of manufacturing of concrete water cement ratio,

Compression test on concrete, tensile strength of concrete, Flexural strength of concrete ,

concrete mix design

Text Books:

1. Concrete Technology by M.S.Shetty, S Chand Publication.

Reference Books:

1. Properties of Concrete by A M Neville, Pearson Publications.
2. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards* (post 2000)
3. Concrete Technology by M. L. Gambhir, TMH Publication.
4. Concrete Technology by S. V. Deodhar, Central Techno Publication

5. Building Materials by S C Rangwala, Charotar Publishing House, India.

NPTEL Links:

1. https://archive.nptel.ac.in/courses/105/104/105104030/ by Sudhir Mishra, IIT Kanpur

Concerned faculty member should suitably frame **SEVEN** laboratory assignments from the following list.

LIST OF PRACTICAL: (Any seven experiments should be performed)

1. Fineness test on cement.

2. Standard consistency test on cement.

3. Soundness test on cement.

4. Initial Setting Time& Final Setting Time of cement.

5. Compressive strength of cement.

6. Fineness modulus of sand.

7. Moisture content of sand.

8. Aggregate impact value.

9. Crushing value of aggregate.

10. Specific gravity of aggregate.

11. Workability test on fresh concrete

12. Compressive strength of strength of concrete (28 days).

13. Spilt tensile strength of concrete

14. Flexural strength on concrete beam

15. Tests on tiles.

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each practical/assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE: ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.
Guidelines: The concerned faculty shall suitably frame FIVE assignments based on above syllabus and the students must submit the assignments in the form of journal.

BIOLOGY FOR ENGINEERS (MDM)					
COURSE OUTLINE					
Course Title:	**BIOLOGY FOR ENGINEERS**	**Short Title:**	**BFE**	**Course Code:**	**CE - 406**

Course description:

This course describes basics and introduction of Biology for various engineering disciplines. It enables students to identify different cell types, functions and biomolecules with their roles. The students were acquainted with the concept of Biomimicry in engineering. After studying the course, student is able to demonstrate the human organ systems and bio-designs.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**02**	**15**	**30**	**02**

Prerequisite course(s):

Course objectives:

Objectives of the course are:

1. To get introduced to different cell types and functions.
2. To understand the biomolecules and their roles.
3. To identify the concept of Biomimicry in engineering.
4. To demonstrate the knowledge of human organ system and bio-designs.
5. To analyze Bioengineering concepts.

Course outcomes:

After successful completion of this course the student will be able to:

1. Identify cell types and their functions and chemistry of cells.
2. Understand Biomolecules with their applications.
3. Identification & applications of Biomimicry in engineering.
4. Correlate the human organ system and bio-designs.
5. Analyze Bioengineering concepts and their applications across different engineering disciplines.

<table>
<tr><th colspan="5">COURSE CONTENT</th></tr>
<tr><td colspan="3">BIOLOGY FOR ENGINEERS</td><td>Semester:</td><td>III</td></tr>
<tr><td colspan="3">Teaching Scheme:</td><td colspan="2">Examination scheme:</td></tr>
<tr><td>Lectures:</td><td colspan="2">2 hours/week</td><td>End semester exam (ESE) UA:</td><td>60 marks</td></tr>
<tr><td colspan="3" rowspan="3"></td><td>Duration of ESE:</td><td>03 hours</td></tr>
<tr><td>Internal Sessional Exams (ISE) CA:</td><td>40 marks</td></tr>
<tr><td>Internal Continuous Assessment (ICA) CA:</td><td>25 marks</td></tr>
<tr><td colspan="2">Unit–I:</td><td>No. of Lectures: 06 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Introduction to Biology: The cell: the basics of a cell. Prokaryotic and Eukaryotic cell, The Plant Cell and animal cell, Chemistry of cells. Cell Division: Cell cycle, mitosis, meiosis, cell division, cell cycle check points, cell death.</td></tr>
<tr><td colspan="2">Unit–II:</td><td>No. of Lectures: 06 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Application of Biomolecules in water filters production, Proteins in food production, lipids in biodiesel and detergents production, Enzymes in biosensors fabrication, food processing</td></tr>
<tr><td colspan="2">Unit–III:</td><td>No. of Lectures: 06 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Biomimicry: Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).</td></tr>
<tr><td colspan="2">Unit–IV:</td><td>No. of Lectures: 06 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Human Organ Systems and Bio Designs: Brain as a CPU system (signal transmission, BCI, EEG). Eye as a Camera system (rod and cone cells, optical corrections, lens materials, bionic eye). Heart as a pump system (electrical signaling - ECG monitoring, design of stents, pacemakers, defibrillators). Lungs as purification system (spirometry, Ventilators, Heart-lung machine, artificial lungs). Kidney as a filtration system.</td></tr>
</table>

Unit–V:	No. of Lectures: 06 Hours	Marks: 12

Bioengineering: Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis.

Text Books:

1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.

Reference Books:

1. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
2. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008
3. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
4. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
5. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Lehninger principles of biochemistry. New York: Worth Publishers
6. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
7. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023

NPTEL Links:

NPTEL Course on Biology for engineers and other non-biologists (4 weeks UG Course) By Prof. G.K. Suraish kumar & Prof. Madhulika Dixit (IIT. Madras)

Guidelines for ICA:

Students must submit ICA in the form of journal. Concerned faculty member should suitably

frame **FIVE** assignments based on the above syllabus. Faculty in charge will assess the assignments continuously, and grade or mark each assignment on completion date declared for each assignment.

BUILDING DESIGN AND DRAWING LAB (VSEC)					
COURSE OUTLINE					
Course Title:	**BUILDING DESIGN AND DRAWING LAB**	**Short Title:**	**BDD LAB**	**Course Code: Theory**	**CE – 408**

Course description:

This lab course introduces students to the fundamental principles and practices of building design and architectural drawing. It focuses on preparing and interpreting architectural plans, elevations, and sections of residential and public buildings using both manual and CAD-based drafting techniques. Students will also gain exposure to building bylaws, functional design, space planning, and the preparation of working drawings according to standard codes and practices.

	Hours/week	No. of weeks	Total hours	Semester credits
Practical	02	15	30	01

Prerequisite course(s): Nil

Course Objectives:

1. To develop skills in architectural drafting and visualization of building elements.
2. To understand the functional aspects of building planning and space utilization.
3. To interpret and apply building bylaws and planning standards.
4. To create architectural plans, elevations, and sections for various types of buildings.
5. To familiarize students with the use of CAD software for preparing building drawings.

Course outcomes:

After successful completion of this course the student will be able to:

1.Interpret building requirements and prepare preliminary architectural sketches.

2.Design and draft building plans, elevations, and sections for residential and public buildings.

3. Apply knowledge of building bylaws and standards in architectural design.

4. Create working drawings and detail drawings for structural and service components.

5.Use CAD software tools to produce professional-quality building drawings.

BUILDING DESIGN AND DRAWING LAB (VSEC)					
LAB COURSE CONTENT					
BUILDING DESIGN AND DRAWING LAB		**Semester:**	**IV**	**Course Code**	**CE – 408**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**

Concerned faculty member should suitably frame **SIX** laboratory assignments from the following list.

LIST OF PRACTICAL- Any **six** practicals should be performed along with CAD drawings and one site visit compulsory.

1. Line plan & detail plan of residential building.
2. Elevation of above plan of residential building.
3. Section along (X-X) and (Y-Y) axis of above residential building plan.
4. Perspective view of building.
5. Layout plan of building including public building.
6. Separate plan for all public building (For 5 number of student one building is allotted)
7. Plan of building.
8. Water supply and drainage arrangement (line plan).

Text Books:

1. Building Planning and Drawing M.G. Shah, C.M. Kale, S.Y. Patki, publisher Tata McGraw Hill Education Pvt. Ltd. Revised Edition, 2013.
2. Civil Engineering Drawing, Author: V.B. Sikka, S.K. Kataria & Sons, Latest Edition, 2020.

Reference Books:

1.Building Drawing – M.G. Shah, C.M. Kale, S.Y. Patki, Tata McGraw-Hill.

2.Building Planning and Drawing" – N. Kumaraswamy & A. Kameswara Rao.Charotar Publishing House.

3.Civil Engineering Drawing – M. Chakraborti,Laxmi Publications

4.Architectural Drawing – D.K. Ching, Publisher: Wiley

5.Building Construction Illustrated – Francis D.K. ChingPublisher: Wiley

6.AutoCAD for Architecture – Paul F. Aubin, Publisher: Autodesk Official Training Guides

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

ABILITY ENHANCEMENT COURSE (AEC)					
COURSE OUTLINE					
Course Title:	**ABILITY ENHANCEMENT COURSE**	**Short Title:**	**AEC**	**Course Code:**	**CE - 409**

Course description:

The Course Provides students English proficiency across four key skills: Listening, Reading, Writing, and Speaking. It is used for study, work, and migration purposes in English-speaking countries.

Practical	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	02	**15**	**30**	**01**

Course Objectives:

The objective of this course is:

1. Evaluate English proficiency for academic, professional, and migration purposes.
2. Provide an internationally recognized standard for English language assessment.
3. Develop language skills necessary for effective communication in diverse environments.
4. Prepare candidates for real-life language use in academic and work-related.
5. To equip students with test-taking strategies to maximize their scores.

Course Outcomes:

After successful completion of this course, the student will be able to:

1. Demonstrate a high level of English proficiency for academic, professional, or migration purposes.
2. Develop leadership and teamwork skills in collaborative environments.
3. Apply effective strategies for all Ability Enhancement modules.
4. Develop confidence in using English in real-life and test situations.
5. Achieve the required Ability Enhancement score for university admissions, work, or immigration.

COURSE CONTENT

ABILITY ENHANCEMENT COURSE		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Practical	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**	**25 Marks**

Concerned faculty member should suitably frame **FOUR** assignments in the form of interactive Practice Sessions based on the following modules.

Listening:

1. **Activity 1:** Podcasts, news, speeches, conversations, storytelling, News websites, BBC CNN, NBC

2. **Practice 1:** Practice with audio materials (podcasts, TED Talks, movies)
3. **Practice 2:** Cornell Method, Mind Mapping, Key Points and Summarization
4. **Practice 3:** Listening tests and quizzes, Practical exercises

Reading:

1. **Activity 3:** Fiction, short stories, novels: News articles, essays, reports, Research papers, textbooks, Blogs, social media posts, online articles
2. **Practice 1:** Self-assessment and comprehension quizzes
3. **Practice 2:** Note-taking strategies for effective retention
4. **Practice 3:** Understanding idioms and figurative language
5. **Practice 4:** Context clues and word recognition

Writing:

1. **Activity 4:** Write a daily journal, Letters to an English speaker, Make lists of the things you see every day, Write descriptions of your family and friends.
2. **Practice 1:** Common writing mistakes and how to fix them.
3. **Practice 2:** Unity in writing (sticking to one main idea)
4. **Practice 3:** Poetry, short stories, scripts
5. **Practice 4:** Storytelling techniques, point of view, dialogue

Text Books:

1. Barron's, IELTS Practice Exam, New Age International Private Limited, 2nd Edition.

Reference Books:

1. IELTS 19 Academic, Authentic Practice Tests, Cambridge University Press,2024
2. Pauline Cullen, IELTS Academic and General Training, Cambridge University Press,2014

NPTEL Links:

1. Skills by Prof. Binod Mishra, IIT Roorkee, https://nptel.ac.in/courses/109107121
2. Skills Development by Prof. P. Patnaik, Prof. V.N. Giri, Prof. D. Suar, IIT Kharagpur, https://nptel.ac.in/courses/109105110

Links: (for online practice)

1. A noticeboard message | Learn English (britishcouncil.org)
2. Free IELTS on Computer familiarisation test (ieltsidpindia.com)

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on the completion date declared for each assignment.

ECONOMICS FOR ENGINEERS (HSSM)					
COURSE OUTLINE					
Course Title:	**ENGINEERING ECONOMICS**	**Short Title:**	**EE**	**Course Code: Theory**	**CE-410**

Course description:

Engineers multiply the production by introducing the machines. But product must be sold in market. They must know the laws of demand and supply. They must know the market economics. Then only their organization can sustain.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**02**	**15**	**30**	**02**

Prerequisite course(s): Nil

Course Objectives:

The objective of this course is to:

1. Cultivate practical problem-solving abilities in real-world project management scenario.
2. Foster critical thinking for analytical evaluation of complex phenomena.
3. Promote interdisciplinary thinking by integrating varied managerial and leadership concepts.

Course outcomes:

After successful completion of this course the student will be able to:

1. After successful completion of this course the student will be able to:
2. Demonstrate deep comprehension of diverse project contents principles and applications.
3. Exhibit advanced proficiency in solving diverse management problems.
4. Critical analysis of experimental data, literature, and theoretical models.
5. Apply integrated management knowledge to solve real-world challenges effectively.

COURSE CONTENT

ECONOMICS FOR ENGINEERS		**Semester:**	**IV**	**Course Code**	**CE –410**
Teaching Scheme:		**Examination scheme**			
Lectures:	**2 hours/week**	**End Semester Exam (ESE) UA:**			--
		Duration of ESE:			--
		Internal Sessional Exam (ISE) CA:			--

Unit–I:	**No. of Lectures: 06 Hours**	**Marks: --**

Definition, scope, and importance of Engineering Economics, fundamental economic concepts

(opportunity cost, time value of money, marginal analysis). Demand and supply analysis. Cost concepts and cost classification, Break-even analysis		
Unit–II:	**No. of Lectures: 06 Hours**	**Marks: --**
Simple and compound interest, Present worth and future worth analysis, Annuities and perpetuities. Depreciation methods (straight-line, declining balance, sum-of-years' digits), Inflation and its impact on economic decisions.		
Unit–III:	**No. of Lectures: 06 Hours**	**Marks: --**
Capital budgeting techniques (NPV, IRR, Payback Period, Benefit-Cost Ratio), Replacement analysis, Risk and uncertainty in economic decisions, , C[st estimation techniques, Life cycle costing		
Unit–IV:	**No. of Lectures: 06 Hours**	**Marks: --**
Sources of finance for engineering projects, Equity vs. debt financing Financial statements (balance sheet, income statement, cash flow statement) Cost of capital and capital structure Project feasibility analysis.		
Unit–V:	**No. of Lectures: 06 Hours**	**Marks: --**
Economic decision-making in engineering projects, Case studies in infrastructure, manufacturing, and technology sectors, Environmental and social cost considerations, Ethics in engineering economics and corporate social responsibility, Government regulations and taxation impact.		
Text Books:		
1. "Engineering Economy" – William G. Sullivan, Elin M. Wicks, C. Patrick Koellingdecision-making strategies in engieering.		
Reference Books: 1. Engineering Economic Analysis" – Donald G. Newnan, Ted G. Eschenbach, Jerome P. Lavelle 2. "Fundamentals of Engineering Economics" – Chan S. Park. 3. "Principles of Engineering Economic Analysis" – John A. White, Kenneth E. Case, David B. Pratt 4. "Contemporary Engineering Economics" – Chan S. Park		

Guidelines: The concerned faculty shall suitably frame **FIVE** assignments based on above syllabus and the students must submit the assignments in the form of journal.

ENVIRONMENTAL SCIENCES					
COURSE OUTLINE					
Course Title:	**ENVIRONMENTAL SCIENCES**	**Short Title:**	**EVS**	**Course Code:**	**CE - 411**

Course description:
The course aims to percolate the importance of environmental science and environmental studies.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	02	15	30	02

Prerequisite course(s):

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. Integrate the knowledge on human interactions with the environment and problems associated with it
2. Analyze the importance of renewable and non-renewable natural resources
3. Learn the fundamentals of ecosystem
4. Learn and conserve the biodiversity and its conservation
5. Analyze the relation between social issues and the environment

Course outcomes:

After successful completion of this course the student will be able to:

1. Evaluate the effectiveness of various environmental policies and practice them as life-long learning
2. Develop the strategies for effective waste management and resource conservation
3. Articulate the interconnected, and interdisciplinary nature of environmental studies
4. Evaluate the local and global scale of environmental problems
5. Communicate complex environmental information to both technical and non-technical audiences.

COURSE CONTENT

ENVIRONMENTAL SCIENCES		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**2 hours/week**	**End Semester Examination (ESE) UA:**	**25 marks**

Unit I	**No. of Lectures: 08 Hours**	**5 Marks**

Multidisciplinary Nature of Environmental Studies and Social Issues

Definition, scope and importance multidisciplinary nature of environmental studies and need for public awareness, From Un sustainable to Sustainable development, Water conservation, rain water harvesting, water shed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions.

Climate change, global warming, acid rain, ozone layer depletion, nuclear

Accidents and holocaust. Case Studies. Waste land reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act Wild life Protection Act Forest Conservation Act Issues involved in enforcement of environmental legislation. Public awareness.

Unit II	**No. of Lectures: 05 Hours**	**5 Marks**

Natural Resources

Renewable and non-renewable resources

Natural resources and associated problems.

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles

Unit III	**No. of Lectures: 08 Hours**	**5 Marks**

Ecosystems, Biodiversity and their Conservations

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the ecosystem like Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Introduction–Definition: genetic, species and ecosystem diversity, Bio geographic classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity,

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Unit IV	**No. of Lectures: 5 Hours**	**5 Marks**

Environmental Pollution

Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Unit V	**No. of Lectures: 04 Hours**	**5 Marks**

Human, Population and the Environment

Population growth, variation among nations. Population explosion–Family Welfare Program, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Reference Books:

1. Agarwal, K. C.2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad – 380 013, India, Email: mapin@icenet.net (R)
3. BrunnerR.C.,1989, Hazardous Waste Incineration, McGrawHillInc.480p
4. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A. K. Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M. L. & School, R. M.1996.EnvironmentalSciencesystems&Solutions, Web

Enhanced edition.639p.

13. Mhaskar A. K. Matter Hazardous, Techno-Science Publication (TB)
14. Miller T. G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E. P.1971. Fundamentals of Ecology.W.B.SaundersCo.USA,574p
16. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. SharmaB.K.,2 001.Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Bachelor of Engineering

in

(Common for all)

(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

COURSE OUTLINE FOR OPEN ELECTIVE - II

For Affiliated Colleges

Semester – IV

W.E.F. 2025 – 26

Open Elective - II

A Student can opt for any one subject out of available institute wide subjects defined in the following list as Open Elective provided, he/she has not taken that particular subject in his/her Programme core, Programme elective, Multidisciplinary Minor, other Open elective and Vocational and Skill Enhancement courses etc. throughout his / her four years of UG Engineering Programme. The student must opt a subject that is compulsorily from faculty other than that of the Major discipline.

Course Code	Name of the Subject / Course	Faculty Offered by	Department Offered by
Open Elective - II (w.e.f. 2025 - 26 at Semester - IV, Second Year Engineering)			
OE – 407 A	Human Resource Management	Comm. & Mgmt.	Management
OE – 407 B	Logical Reasoning and Problem Solving	Sci. & Tech.	Mathematics
OE – 407 C	Retail Management	Comm. & Mgmt.	Commerce
OE – 407 D	Public Health and Hygiene	Sci. & Tech.	Zoology
OE – 407 E	Agricultural Pest Management	Sci. & Tech.	Zoology
OE – 407 F	Basics of Stock Markets	Comm. & Mgmt.	Commerce
OE – 407 G	Problems of Philosophy	Humanities	Philosophy
OE – 407 H	Social and Preventive Pharmacy	Sci. & Tech.	Pharmacy

HUMAN RESOURCE MANAGEMENT (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**HUMAN RESOURCE MANAGEMENT**	**Short Title:**	**HRM**	**Course Code:**	**OE – 407 A**

Course description:

This course provides a comprehensive understanding of Human Resource Management (HRM), including key functions such as talent acquisition, performance management, training and development, and compensation management. It also covers emerging trends like AI in HR, digital HR, people analytics and sustainable HRM practices.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):Nil

Course objectives:

The objective of this course is to impart knowledge so that the student will:

1. To understand the fundamental principles and functions of HRM.
2. To analyse workforce planning, recruitment, selection, and retention strategies.
3. To evaluate performance management systems, appraisal techniques, and key HR metrics.
4. To assess training and development programs to enhance employee skills and productivity.
5. To explore digital HR, work-life balance, compensation strategies, and sustainable HRM practices.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain HRM concepts and their significance in business operations.
2. Apply talent acquisition and retention strategies in an organizational context.
3. Implement performance appraisal and feedback systems effectively.
4. Develop employee training and development programs for career growth.
5. Utilize modern HR tools and technologies to enhance organizational efficiency.

COURSE CONTENT

HUMAN RESOURCE MANAGEMENT		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**4 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Basics of Human Resource Management

Introduction to HRM: Meaning, Definitions, Nature and Objectives,

Functions of HRM: Managerial and Operative Functions

Differences between HRM, Personnel Management, and HRD

Role of HR Managers: Skills, Qualities, and Future Challenges

Emerging Trends: AI in HR, Digital HR, and People Analytics

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Talent Acquisition and Management

Human Resource Planning (HRP): Concept, Need, Characteristics, Benefits, Process.

Recruitment: Concept, Purpose, Sources, and Process

Selection: Concept, Process, Selection Tests, and Barriers

Placement: Concept and Problems

Induction/Orientation: Concept, Objectives, Steps, Problems

Promotion, Demotion, Transfer, Layoff, Downsizing, Rightsizing, and

Voluntary Retirement Scheme (VRS)

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Performance Management and Appraisal

Performance Management: Concept, Objectives, and Modern Approaches

Performance Appraisal: Concept, Need, and Importance

Performance Appraisal: Traditional Methods and Modern Methods

Key Performance Indicators (KPIs) and Balanced Scorecard Approach

Bias in Performance Appraisal: Types and Ways to Mitigate

Legal and Ethical Issues in Performance Appraisal

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Training and Development

Definitions, Need, and Objectives of Training & Development

Concept and Importance of Executive Development

Training Methods: On-the-Job and Off-the-Job Methods, Virtual Learning and

E-Learning Platforms

Evaluating Training Effectiveness: Tools and Models

Difference between Training, Development, and Education

Career Development and Succession Planning

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Advanced HRM Practices

HRM in the Digital Age: HRIS (Human Resource Information System) and Digital Transformation

Work-Life Balance: Flexible Work Models, Hybrid Work, and Employee Wellbeing

Compensation Management: Wage and Salary Administration, Incentives, and Benefits

Sustainable HRM: Green HRM, Corporate Social Responsibility (CSR) in HR, and Ethical HRM

Text Books:

1. "Human Resource Management: Text and Cases" by Dr. V.S.P. Rao (Excel Books)

Reference Books:

1. Human Resource Management By Dr. Shikha Kapoor - Taxmann
2. Human Resource Management By Dr K. Ashwathappa – Tata McGraw Hill
3. Essentials of Human Resource Management By P. SubbaRao – Himalaya Publishing House
4. HR From the Outside In: Six Competencies for the Future of Human Resources –
5. Boudreau & Cascio - McGraw-Hill Education- ISBN: 978-0071790351

NPTEL Links:

1. Principles of HRM by Prof. Aradhna Malik
   https://archive.nptel.ac.in/courses/110/105/110105069/
2. Talent Acquisition and Management by Prof. Santosh Rangnekar
   http://kcl.digimat.in/nptel/courses/video/110107152/L19.html
3. Performance & Reward Management by Prof Susmita Mukhopadhyay
   https://archive.nptel.ac.in/courses/110/105/110105137/
4. Training and Development by Prof. Susmita Mukhopadhyay and Prof. S. Srinivasan
   https://onlinecourses.nptel.ac.in/noc22_hs63/preview

LOGICAL REASONING AND PROBLEM SOLVING (Open Elective – II)

COURSE OUTLINE

Course Title:	LOGICAL REASONING AND PROBLEM SOLVING	Short Title:	LRPS	Course Code:	OE – 407 B

Course description:

The Logical Reasoning course is designed to enhance a student's ability to think critically and make reasoned judgments through structured and logical thought processes. This course focuses on developing key skills required to analyze patterns, relationships, and arguments, which are essential for solving complex problems. Throughout the course, students will be exposed to various types of logical reasoning problems, including deductive and inductive reasoning, analogies, sequences, and puzzles.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	15	45	03

Prerequisite course(s):Nil

Course objectives:

1. Course will provide an introduction to logical and philosophical reasoning.
2. To enhance the analytical skill and problem solving skill of the students.
3. To improve verbal and non-verbal reasoning ability skill of the students

Course outcomes:

After successful completion of this course the student will be able to:

1. Choose analogy and classification, and perform coding and decoding on data
2. Evaluate arguments, identify assumptions, and recognize logical fallacies, strengthening their ability to think critically and make informed decisions.
3. Recognize logical reasoning applicable to real-life situations and solve real-life problems
4. Apply critical thinking in analyzing number patterns, ranks, and time sequences, fostering decision-making skills that are crucial for problem-solving.
5. Develop the ability to identify and interpret visual patterns and sequences.

COURSE CONTENT

LOGICAL REASONING AND PROBLEM SOLVING		Semester:	IV
Teaching Scheme:		Examination Scheme:	
Lectures:	3 hours/week	End Semester Exam (ESE) UA:	60 marks
		Duration of ESE:	03 hours
		Internal Sessional Exam (ISE)	40 marks

	CA:	
Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**
Analogy : Completing the analogous pair, Direct/ Simple Analogy, Choosing the analogous pair, Double Analogy Choosing a similar word, Detecting Analogies, Multiple word analogy, Number analogy, Alphabet Analogy **Classification :** Choosing the odd word, Choosing the odd pair of word, Choosing the odd numeral, Choosing the odd numeral pair/ group **Coding and Decoding :** Letter coding, Direst letter coding, Number/ Symbol Coding, Matrix Coding , Substitution, Deciphering message word codes, Deciphering number and symbol codes for messages. **Blood relations:** Deciphering jumbled up descriptions, Relation puzzle, Coded relations		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Direction sense Test : Directions and Cardinal Directions , Direction puzzle **Logical Sequence of words :** Sequence in process , Sequence in object formation **Data Sufficiency** : Yes/No Questions, Value Questions **Verification of Truth of the Statement:** Relationship with the thing mentioned. **Sequential Output Tracing**		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Logic : Logical Reasoning, Logical Deduction , Two- Premise Arguments, Three-Premise Arguments **Statement – Arguments :** Strong arguments and weak Arguments **Statement –assumption :** Type 1- implicit statement, Type2-Implicit in Context **Statement –Conclusions :** Direct / indirect implications of conclusions **Cause and Effect Reasoning**		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Logical Venn Diagrams: Type 1, Type 2 **Number, Ranking and Time Sequence Test:** Type 1: Number Test, Type 2: Ranking Test, Type 3: Time Sequence Test **Mathematical Operations** Type 1: Problem-Solving by Substitution, Type 2: Interchange of Signs and Numbers, Type 3: Deriving the Appropriate Conclusions **Arithmetical Reasoning:** Type 1: Calculation-Based Problems, Type 2: Data-Based Questions, Type 3: Problems on Ages, Type 4: Venn-Diagram Based Questions		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
NON-VERBAL REASONING:		

Classification: Choosing the Odd Figure, Choosing a Similar Figure, Finding Figures with the Same Characteristics,

Analytical Reasoning

Mirror-Images : Mirror-Images of Capital letters, Small letters, Numbers and figures

Water-Images : Water-Images of Capital letters, Small letters, Numbers and figures

Cubes and Dice : 2D and 3D cubes, Number opened dice and Letter opened dice

Text Books:

1. Dr. R.S. Aggarwal "A Modern Approach to Verbal & Non-Verbal Reasoning" by S. Chand Publication.

RETAIL MANAGEMENT (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**RETAIL MANAGEMENT**	**Short Title:**	**RM**	**Course Code:**	**OE – 407 C**

Course description:

This course provides an in-depth understanding of retail management, covering key concepts such as retail formats, consumer behavior, supply chain management, and e-retailing. It explores the role of technology in retail, sustainable business practices, and emerging retail trends. The course equips students with the knowledge and skills required to manage retail operations efficiently and explore entrepreneurial opportunities in the retail sector.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Course objectives:

The objective of this course is to:

1. Understand the fundamentals of retailing, consumer behavior, and key retail formats.
2. Analyze retail operations, supply chain management, and technology integration in retail.
3. Apply e-retailing strategies and digital innovations to enhance customer experience.
4. Evaluate sustainable and ethical retail practices and their impact on business.
5. Develop entrepreneurial skills by exploring emerging trends and business opportunities in retail.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain the core concepts, significance, and evolution of retailing.
2. Analyze retail supply chain, store operations, and digital retail transformations.
3. Apply technology-driven solutions like AI, IOT, and block chain in retail management.
4. Evaluate sustainable retail models and ethical business practices.
5. Develop innovative retail business strategies and entrepreneurial ventures.

COURSE CONTENT

RETAIL MANAGEMENT		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**
Unit–I:	**No. of Lectures: 09 Hours**		**Marks: 12**

Fundamentals of Retailing		
Retailing: Definition, significance, and evolution Retail formats, business models, and ownership structures Consumer behavior and purchase decision-making Key drivers of retail growth in India and globally		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Retail Organization and Supply Chain Management		
Store location, layout, and visual merchandising Inventory control, logistics, and warehouse management POS systems, cash handling, Role of automation in retail operations		
Unit-III	**No. of Lectures: 09 Hours**	**Marks: 12**
E-Retailing and Digital Transformation		
Growth of e-commerce and omnichannel retailing AI, IoT, and blockchain applications in retail Customer data management and personalized marketing strategies Role of AR/VR in enhancing customer experience Cybersecurity and data privacy in online retailing		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Sustainable and Ethical Retailing		
Sustainability and green retailing practices Ethical sourcing and fair trade in retail Waste management and circular economy in retail Impact of government policies and regulations on retailing		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Future Trends and Entrepreneurship in Retail		
Retail analytics and business intelligence for decision-making Startups and innovation in retail entrepreneurship Franchising and global retail expansion Emerging trends: Quick commerce, Direct-to-Consumer (DTC) models Case studies on innovative retail success stories		
Text Books:		
1. “Retailing Management – Text and Case” (7th Edition) by Swapna Pradhan, Tata McGraw Hill		
Reference Books:		

1. Suja Nair, Retail Management, 2011 Edition, Generic, 2015.
2. R. S. Tiwari, Retail Management, Himalaya Publishing House.
3. Francois Chaubard, AI for Retail: A Practical Guide to Modernize Your Retail Business with AI and Automation, Wiley, 2023
4. Michael Levy, Barton A. Weitz and, Dhruv Grewal Professor Retailing Management, McGraw Hill; 10th edition (4 January 2018)
5. Gibson G. Vedamani, "Retail Management- Functional Principles and Practices", Jaico Publishing House, Mumbai.

NPTEL Links:

1. Retail Management by By Prof. Swagato Chatterjee, IIT Kharagpur.

https://onlinecourses.nptel.ac.in/noc25_mg56/preview

PUBLIC HEALTH AND HYGIENE (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**PUBLIC HEALTH AND HYGIENE**	**Short Title:**	**PHH**	**Course Code:**	**OE – 407 D**

Course description:

This course provides a comprehensive understanding of public health and hygiene practices, exploring their significance in preventing disease, promoting well-being, and improving the quality of life for individuals and communities. Students will learn about the principles and strategies involved in maintaining public health, the role of hygiene in disease prevention, and the impact of environmental and behavioral factors on health.

	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	**03**	**15**	**45**	**03**

Prerequisite course(s):Nil

Course objectives:

1. Gain knowledge of common food-borne and water-borne diseases (causes, symptoms, transmission), and apply strategies for prevention and control.
2. To impart basic and technical knowledge on nursery management for strengthening of horticulture sector.
3. To study the disease and pest controlling nursery with practical experience.

Course outcomes:

1. Demonstrate the ability to design balanced meal plans considering calorie needs and dietary requirements for different individuals and life stages.
2. Effectively communicate the causes, symptoms, and prevention strategies for common food-borne and water-borne diseases.
3. Competently demonstrate essential personal hygiene practices and advocate for social hygiene initiatives in the community.
4. Articulate the negative health consequences of unhealthy habits and positively promote physical activities like cycling and walking, stress management techniques (yoga), and responsible family planning methods.
5. Develop an understanding of nutrition principles, balanced diets, and dietary needs for different life stages (infants, children, adults, pregnancy, and lactation), promoting healthy eating practices for disease prevention.

COURSE CONTENT

PUBLIC HEALTH AND HYGIENE		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
Unit–I:	**No. of Lectures: 09 Hours**		**Marks: 12**

Nutrition and health:

Introduction: Scope and importance of Public health and hygiene. Balanced diet, diet control for diabetics and cholesterol, etc. Concept of energy, calories, daily food intake as per occupation, pregnancy and lactation. Dietary requirements of infants, pre-school children, schoolchildren, adults.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Health Hazards:

Health dynamicity – definition, factors influencing health, health as a medium of socio-economic development. Diseases – Common food borne and water borne diseases (jaundice, cholera, diarrhea and typhoid) – causative agents, symptoms, mode of transmission, prevention and control.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Health hygiene:

Personal hygiene, body odour, oral hygiene and sexual hygiene, grooming, feminine hygiene, sleep hygiene, hand washing, toiletry. Social hygiene – clean living movements, occupational hygiene, food and cooking hygiene, medical hygiene, excessive hygiene.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Health Education:

Definition, objectives, principles ,effects of smoking, alcoholism and drug abuse (hashish, opium, brown sugar).Population control and family welfare- use of contraceptives Importance of Body fitness Importance of cycling and walking exercise. Stress reduction management – Importance of yoga Sickle Cell Disorder.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Healthy Lifestyle:

Lifestyle habits ,**Balanced Diet** , **Stress Management,** Benefits of a Healthy Lifestyle,
Excessive usage of T.V., computer, mobile phones, two wheelers, and their impacts on health.

Text Books:

1. “Essentials of Public Health and Sanitation – Part I- IV” by Jatin V. Modi and Renjith S. Chawan.

Reference Books:

1. Murray, C. J. L. and A.D. Lopez. (1996), The Global Burden Of Disease. World Health Organization.
2. Park, J.E. and Park, K. Textbook of Community Health for Nurses.
3. Swaminathan S. Principles of Nutrition and Dietetics.

NPTEL Links:

1. **One Health-**By One Health Instructors ICMR - Regional Medical Research Centre, Bhubaneswar

(One Health - Course (nptel.ac.in)

2. **Basics of Health Promotion and Education Intervention**

   By Dr. Arista Lahiri, Dr. Sweety Suman Jha, Dr. Madhumita Dobe, Dr. Chandrashekhar Taklikar | IIT Kharagpur, IIT Kharagpur, AIIH&PH, Kolkata, AIIH&PH, Kolkata

   (Basics of Health Promotion and Education Intervention - Course (nptel.ac.in))

AGRICULTURAL PEST MANAGEMENT (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**AGRICULTURAL PEST MANAGEMENT**	**Short Title:**	**APM**	**Course Code:**	**OE – 407 E**

Course description:

This course provides a comprehensive understanding of the tactics and practices of managing pests in agricultural systems. It covers the identification, biology, and ecology of common agricultural pests. Students will learn integrated pest management (IPM) strategies that combine biological, cultural, physical, and chemical control methods to minimize pest damage while promoting environmental sustainability and economic viability**.**

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Biology, Environmental Science

Course objectives:

The objective of this course is to:

1. To understand agricultural pest management.
2. To learn economic impacts of integrated pest management and decision making.
3. To improve the biological precepts and sampling for detection convey.
4. To learn management of insect pests of cotton and rice.
5. To understand management of insect pests of vegetable crops and oilseeds.

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply the concept of agricultural pest management.
2. Co-relate the economic impacts of integrated pest management and decision making.
3. Acquire skill of the biological precepts and sampling for detection.
4. Illustrate the management of insect pests of Cotton and rice.
5. Demonstrate and analyze the management of insect pests of vegetable crops and oilseeds.

COURSE CONTENT

AGRICULTURAL PEST MANAGEMENT		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

The IPM paradigm: concepts, strategies and tactics and Economic impacts of IPM

Historical perspectives, Early conceptual efforts in Integrated Pest Management (IPM} development, Kinds of pests, Pest management strategies and tactics, Funding IPM research and

implementation, Measuring IPM implementation. Economic impacts of IPM: Measuring IPM adoption, Individual economic impacts to the IPM user, Analyzing typical adoption cases using budgets, Analyzing optimal IPM decisions, Aggregate or market-level economic impacts of IPM, 1 Capturing price effects when IPM impacts are large, Aggregating economic impacts over time, Valuing health and environmental impacts.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Economic decision rules for IPM and Decision making and economic risk in IPM

Economic decision rules for IPM: Economic decision levels, The EIL, The ET, Development of EILs and ETs, Current approaches, Limitations to EILs and ETs. Decision making and economic risk in IPM: Defining IPM within a management context, Economic injury level (EIL) and economic threshold (ET), Risk and IPM, Representing risky situations, Decision making criteria and tools, Risk preferences defined.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

IPM as applied ecology-the biological precepts and Sampling for detection, estimation and IPM decision making

IPM as applied ecology-the biological precepts: Life systems, Pest population dynamics, Stochastic models and meta populations, Population structure and life tables, Population stability and species diversity, Open and closed ecosystems, Scale and ecologically based pest management Sampling for detection, estimation and IPM decision making: Basics of sampling, Necessary sample size, Detection sampling, Estimation sampling, Decision sampling.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Management of Insect Pest of Cotton and Rice

Management of Insect Pests of Cotton: Introduction Changing Insect Pest Scenario, Cultural, Mechanical, and Physical Control, Microbial Control, Biological Control, Botanical Control, Chemical Control, Integrated Pest Management. Management of Insect Pests of Rice: Introduction, Component of Integrated Pest Management, Cultural Methods, Biological Control, Behavior modifying chemicals, Botanical Bio pesticides.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Management of Insect Pests of Vegetable Crops and Oilseeds

Management of Insect Pests of Vegetable Crops in Net House: Introduction, Physical Control, Cultural Control, Mechanical Control, Biological Control, Botanical Control. Management of Insect Pests of Oilseeds Crops: Rapeseed-Mustard, Sunflower, Groundnut, Sesamum, Linseed.

Textbooks:

1. "Integrated Pest Management, Concepts, Tactics, Strategies and Case Studies" by Edward B. Radcliffe, William D. Hutchison, Rafael E. Cancelado, Cambridge Publishing.

Reference Books:

1. "Integrated Pest Management for Crops and Pastures" by Paul Horne, Jessica Page, Land Links Publishing
2. "Encyclopedia of Pest Management" Volume II, by Devid Pimentel, CRC Press Taylor and Francis Group Publishing.
3. "Theory and Practice of Integrated Pest Management" by Ramesh Arora, Balwinder Singh, A.K. Dhawan, Scientific Publisher.

NPTEL Links:

1. Integrated Pest Management (IPM) by IIT Kanpur.
   https://archive.nptel.ac.in/courses/126/104/126104003/

BASICS OF STOCK MARKETS (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**BASICS OF STOCK MARKETS**	**Short Title:**	**BSM**	**Course Code:**	**OE – 407 F**

Course description:

This course introduces students to the fundamental concepts of stock markets, investment avenues, and trading mechanisms. It covers the structure and functioning of Indian financial markets, types of securities, stock trading strategies, mutual funds, and regulatory frameworks. The course also emphasizes investor protection measures, risk management, and financial literacy to enable informed decision-making in stock market investments.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Course objectives:

The objective of this course is to:

1. Remember and define the fundamental concepts of stock markets and various investment instruments.
2. Understand the structure, organization, and functioning of financial markets in India.
3. Apply knowledge of primary and secondary market operations, trading mechanisms, and investment avenues.
4. Analyze stock trading strategies, risk-return factors, and investor protection measures.
5. Evaluate the role of regulatory bodies and ethical investment practices in the stock market.

Course outcomes:

1. After successful completion of this course the student will be able to:
2. Describe the functioning and significance of stock markets in the Indian financial system.
3. Classify different types of investment instruments and explain their characteristics.
4. Examine stock trading mechanisms, market indices, and risk-return factors.
5. Develop basic investment strategies and assess stock market operations.

COURSE CONTENT

BASICS OF STOCK MARKETS		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction		
Saving vs Investment – Understanding the Need for Investment Types of Investment Instruments – Equity Shares, Preference Shares, Bonds, Debentures, Government Securities, Sovereign Gold Bonds Overview of Stock Exchanges – BSE, NSE & Their Indices Difference Between Trading & Investment in Stock Market		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Types of Market and Derivatives		
Types of Markets – Primary & Secondary Markets Primary Market – IPO, Credit Rating Agencies, Underwriting, Grey Market Secondary Market – Stock Brokers, Sub Brokers, Listing of Shares, Depositories Basics of Derivatives – Futures, Options, Call & Put, Commodity & Financial Derivatives		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Mutual Funds and Investment Avenues		
Concept and Advantages of Mutual Funds Types of Mutual Funds – Equity, Debt, Liquid, Hybrid, Growth, Income, Tax-Saving, Pension Funds Role of Asset Management Companies (AMCs) and Fund Managers Factors to Consider Before Investing in Mutual Funds		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Stock Trading and Investment Strategies		
Basics of Stock Trading – How to Open a Demat & Trading Account Stock Order Types – Market Order, Limit Order, Stop Loss, Intraday Trading Understanding Stock Market Indices and Their Importance Risk & Return Analysis – Concept of Diversification, Systematic vs. Unsystematic Risk		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**
Regulatory Framework & Investor Protection		
Role of SEBI (Securities and Exchange Board of India) in Stock Market Regulation Investor Protection Mechanisms – Grievance Redressal, Investor Rights & Duties Common Stock Market Frauds & Scams – Insider Trading, Pump & Dump Schemes Overview of Taxation on Stock Market Investments – Capital Gains Tax, Securities Transaction Tax		
Text Books:		
1. Prasanna Chandra, “Investment Analysis and Portfolio management”, Tata McGraw Hill,3rd Edn., 2008		

Reference Books:

1. Bharati V. Pathak, "The Indian Financial System: Markets, Institutions and Services", Pearson education, 3rd edn.
2. Bhole I. M.: "Financial Markets and Institutionals": Tata McGraw Hill, New Delhi.
3. Chandler M. V. and Goldfeld S. M: Economics of Money and Banking: Harper and Row, New York.
4. Edwin J. Elton, Martin J. Gruber, Modern Portfolio Theory and Investment Analysis, 8 th edition, John Wiley & Sons, 2010
5. SEBI Manual, 33rd edition, Taxmann Publications, 2019
6. Shashi K Gupta, Security Analysis Portfolio Management, 1st edition, Kalyani Publishers, 2010
7. Julian Walmsley, "New Financial Instruments", John Wiley & Sons, 2nd edition, Inc 1998
8. PunithavathyPandian, Security Analysis and Portfolio Management, 2nd edition, Vikas Publishing House Pvt. Ltd., 2013
9. Dhanesh Khatri, Security Analysis and Portfolio Management, 1st edition, MacMillan Publishers, 2010

NPTEL Links:

1. Financial Institution and Market
https://archive.nptel.ac.in/courses/110/105/110105121/

PROBLEMS OF PHILOSOPHY (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**PROBLEMS OF PHILOSOPHY**	**Short Title:**	**POP**	**Course Code:**	**OE – 407 G**

Course description:

This course explores some of the central questions and issues in philosophy, designed to introduce students to fundamental philosophical problems and to develop their critical thinking skills. The course covers a broad range of topics, including metaphysics, epistemology, ethics, philosophy of mind, philosophy of language, and political philosophy. Students will examine classic and contemporary texts by influential philosophers, critically analyze their arguments, and engage with different philosophical traditions.

	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	**03**	**15**	**45**	**03**

Prerequisite course(s):Nil

Course objectives:

1. To provide knowledge of philosophical Theories
2. To create awareness about Indian and western Philosophy
3. To understand Theory's Problem of Change, Problem of Self, Problem of Values
4. To understanding various Self of Philosophy
5. Help students understand key ethical dilemmas and encourage thinking about how philosophy informs moral decisions, ethical theory, and the application of ethical principles in real-world situations.

Course outcomes:

1. Students will understand knowledge of philosophical Theories
2. Students will understand about Problem of Change, Problem of Self.
3. Students will to understand Values
4. Students will to understand theory of causation
5. Developing the ability to critically analyze and evaluate philosophical arguments, identifying strengths and weaknesses in reasoning.

COURSE CONTENT

PROBLEMS OF PHILOSOPHY		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Nature of Philosophy:

Concept and definition of Philosophy according to Empiricism, Rationalism, Advait Vedanta, Buddhism. Scope of Philosophy in relation to Natural Sciences, Social Sciences, Political Science, Economics and Sociology, Religion.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Problem of Knowledge:

Western approach of Empiricism and Rationalism (Locke and Leinbnitz) , Indian approach of Empiricism and Rationalism (Charvaka and Nyaya) ,Sources of knowledge, Perception , Inference , Intuition , Testimony.

Unit–III	No. of Lectures: 09 Hours	Marks: 12

Problem of Change:

Concept of change and permanence , Theories of change and causation Satkaryavad (Samkhya) Arambhavada (Nyaya), Aristotle's four fold theory of causation, Hume's theory of causation, and Mill's concept of causation.

Unit–IV	No. of Lectures: 09 Hours	Marks: 12

Problem of Self

Nature of Self, Concept of self-according to Plato ,Descartes ,Samkhya ,Buddhism

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Problem of Values

Nature of values and their role in human life, Kinds of values ,Moral ,Aesthetic Problem of Truth, Correspondence Theory of Truth ,Coherence Theory of Truth ,Pragmatic Theory of Truth.

Text Books:

1. "The problems of philosophy" by Russell, B. (1959) New York, Oxford University Press.

Reference Books:

1. Moore G. E.-Some Main Problemsof Philosophy
2. Durant Will-The Pleasures of Philosophy
3. Hawking W. E- Types of Philosophy
4. Ewing A. C.-The Fundamental Questions of Philosophy
5. Ayer A. J.-The Central Questions of Philosophy

NPTEL Links:

1. **Philosophy and Critical Thinking-**By Prof. Gyan Prakash | Indian Institute of Technology (Indian School of Mines), Dhanbad, India
   Philosophy and Critical Thinking - Course (nptel.ac.in)
2. **Indian Philosophy-Prof. Satya Sundar Sethy** is a Professor in the Department of Humanities and Social Sciences, IIT Madras.
   Indian Philosophy - Course (nptel.ac.in)

SOCIAL & PREVENTIVE PHARMACY (Open Elective – II)					
COURSE OUTLINE					
Course Title:	**SOCIAL & PREVENTIVE PHARMACY**	**Short Title:**	SPP	**Course Code:**	**OE – 407 H**

Course description:

This course is designed to impart basic knowledge on public health, epidemiology, preventive care and other social health related concepts. Also, to emphasize the roles of students in the public health programs.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**

Prerequisite course(s): Nil

Course objectives:

1. The objective of this course is to:
2. Preventive healthcare.
3. Public health and national health programs.
4. Food and nutrition related health issues.
5. Health education & social promotion of maintenance of health.

Course outcomes:

1. After successful completion of this course the student will be able to:
2. Describe various sources of health hazards and disease preventive measures.
3. Discuss the health care issues associated with food and nutritional substances.
4. Describe the general roles and responsibilities of students in public health.
5. Create awareness so that health status of society can be raised.

COURSE CONTENT

SOCIAL & PREVENTIVE PHARMACY		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to social Pharmacy

Definition & Scope: Social Pharmacy as a discipline & its scope in improving public health.

Concept of health: WHO definition, various dimensions, determinants and health indicators.

Public and private health system in India, national health mission.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Environment and Health

Water pollution, importance of safe drinking water, waterborne diseases, air pollution, noise

pollution, sewage and solid waste disposal, occupational illness. Psychosocial Pharmacy: Drugs of misuse and abuse- psychotropic, narcotics, alcohol, tobacco products. Social impact of these habits on social health and productivity and suicidal behaviors.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

First Aid

Need for emergency treatment, emergency treatment in shock, snake bite, burns, poisoning, fractures, resuscitation methods.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Nutrition and Health

Basics of nutrition: Macronutrients and Micronutrients, Importance of water & fiber in diet, Balanced diet, Malnutrition, nutrition deficiency diseases, ill effects of junk foods, caloric & nutrients values of various foods, fortification of food, Introduction to food safety, adulteration of foods, effects of artificial ripening, use of pesticides, genetically modified foods, Dietary supplements, nutraceuticals, food supplements, indications, benefits, Drug –Food interactions.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Epidemiology

Introduction to epidemiology, and its applications. Understanding the terms epidemic, pandemic, endemic, mode of transmission, outbreak, quarantine, isolation, incubation period, contact tracing, morbidity, mortality, Causative agents, mode of transmission and prevention of following communicable diseases, Respiratory infections- Mumps, Influenza(including Avian-Flu, H1N1, SARA,COVID-19), whooping cough, tuberculosis., Intestinal infections- Viral hepatitis, acute diarrheal disease, typhoid, food poisoning, Arthropod-borne disease- dengue, malaria, chikungunya, STDs, HIV/AIDS.

Text Books:

1. New approach to Social Pharmacy, S.P.S. Khurana Pee Vee publications.

Reference Books:

1. Social Pharmacy: Tayler, Geoffrey. Pharmaceutical Press. London.
2. Social Pharmacy: Innovation and Development. Geoff Harding, Sarah Nettleton and Kevin Taylor. The Pharmaceutical Press.
3. Community Pharmacy Handbook- Jonathan Waterfield.
4. Essentials of Community Medicine- Apracical approach, Hiremath Lalita D, Hiremath Dhananjaya A 2nd Edition, 2012,ISBN: 9789350250440, JAYPEE Publications.
5. A text book of Health Education & Community Pharmacy, Dr. Anees Siddique, Birla publications

EXIT COURSE FOR U. G. DIPLOMA in Civil (Duration 8 weeks)

Internship / Apprenticeship:

Internship / Apprenticeship / OJT shall be corresponding to the programme (Major) subject. Internship / Apprenticeship / OJT shall be monitored jointly by faculty and Industry / organization mentor.

The role of a Mentor, nominated by institute, shall be to provide professional/research guidance to the student during the internship. They shall also facilitate networking with other subject matter experts/professionals, which will enhance the internship experience and learning of the students.

Internship / Apprenticeship / OJT corresponding to the programme (Major) subject in Exit course with an external organization / entity is desirable. External organization may be industries, research institutions, University research centers or CSIR laboratories. Internship / Apprenticeship / OJT shall be preferably in offline mode, however online mode may also be permitted.

Preferably the Mini Project in Exit course shall be based on Internship / Apprenticeship / OJT.

Activities under Internship / Apprenticeship / OJT include Project work, Seminar, Industrial Training (excluding credits for Advanced Courses). This can be Industrial / Govt. / NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship / academic / industry research project.

After completion of Internship, students shall prepare a comprehensive report highlighting their learnings and takeaways during the internship period. The students are mandated to give a seminar based on the internship undertaken before an expert committee constituted by the concerned department and the assessment of internship shall be based on the following criteria:

1) Quality and effectiveness of presentation
2) Depth of knowledge and demonstrated skills
3) Variety and relevance of learning experience

4) Practical applications and relationships with concepts taught in the course
5) Internship Report
6) Attendance record, student diary (log), supervisor evaluation

Attendance record shall include daily attendance with IN and OUT time. It shall be signed by Industry supervisor.

Student Diary (log) shall include daily activities carried out by the student during Internship with Task assigned, Activities performed, key learnings etc. It shall be signed by Industry supervisor.

Supervisor evaluation form shall include the following with ratings in FIVE-point scale.

1) Behaviours
2) Performs in a dependable manner
3) Cooperates with co-workers and supervisors
4) Shows interest in work
5) Learns quickly
6) Shows initiative
7) Produces high quality work
8) Accepts responsibility
9) Accepts criticism
10) Demonstrates organizational skills
11) Uses technical knowledge and expertise
12) Shows good judgment
13) Demonstrates creativity/originality
14) Analyzes problems effectively
15) Is self-reliant
16) Communicates well
17) Writes effectively
18) Has a professional attitude
19) Gives a professional appearance
20) Is punctual
21) Uses time effectively

Supervisor evaluation form shall be signed by Industry supervisor.

Mini project:

The student shall carry out a Mini project based on the knowledge acquired during the degree course and/or Internship. The project may be either fully theoretical/practical or involving both theoretical and practical work to be assigned by the guide / mentor / department. The work may also be Study/Survey/Design or R&D work. The work may also be on specified task or project assigned to the students during Internship. The project may also be a sponsored project. The project shall be corresponding to the programme (Major) subject.

Upon completion of the Mini project, the student shall submit project report in the form of hard bound. Assessment for the Mini project shall also include presentation by the student. Assessment of Mini project shall be based on the following criteria:

1) Problem Identification / Project Objectives
2) Methodology / Design
3) Implementation
4) Results and Discussion
5) Conclusion
6) Report
7) Depth of Understanding
8) Presentation
9) Demonstration of the project

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Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY, JALGAON
(M.S.)

Bachelor of Engineering – Honors
in
Infra Structural Engineering
for Second Year Bachelor of Engineering
in
Civil
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Honors in Infra Structural Engineering

Syllabus Structure for Honors in Infra Structural Engineering: Additional Credit (Semester – III) (w.e.f. 2025 – 26) (As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE - 311A	Theory of Elasticity and Plasticity	PCC	3			3	40	60			100	3
CE - 312A	Theory of Elasticity and Plasticity Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Honors in Infra Structural Engineering: Additional Credit (Semester – IV) (w.e.f. 2025 – 26) (As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE - 414A	Public Health Structures	PCC	3			3	40	60			100	3
CE - 415A	Public Health Structures Lab	PCC			2	2			25	25 (OR)	50	1

THEORY OF ELASTICITY AND PLASTICITY (PCC)					
COURSE OUTLINE					
Course Title:	**THEORY OF ELASTICITY AND PLASTICITY**	**Short Title:**	**ISM**	**Course Code:**	**CE-311A**
Course description:					
	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**	
Theory	**03**	**15**	**45**	**03**	
Prerequisite course(s): Nil					
Course objectives:					

The primary objective of this course is to provide students with an in-depth understanding of the fundamental concepts, theories, and mathematical formulations in elasticity and plasticity. The course aims to equip students with the knowledge to analyze and solve real-world engineering problems related to materials subjected to different stress states. Students will gain the skills to apply principles of solid mechanics in the design and analysis of structures and components in a variety of engineering fields.

Course outcomes:

1. **Understand and apply fundamental principles** of elasticity and plasticity to analyze solid body deformation.
2. **Formulate and solve problems** related to stress and strain in elastic materials using equilibrium, compatibility, and material laws.
3. **Derive and apply governing equations** for elasticity (Navier's equations, plane stress, and plane strain conditions).
4. **Understand the concept of plasticity** and differentiate between elastic and plastic behavior in materials.
5. **Analyze and solve problems in plastic deformation**, including yield criteria, flow rules, and hardening models.

COURSE CONTENT			
THEORY OF ELASTICITY AND		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**		
		End Semester Examination (ESE)	**60 marks**
		Internal Sessional Exam (ISE) CA:	**40 marks**
Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**	

Introduction to Elasticity

Stress and Strain, Types of Stress and Strain, Principal Stresses and Strains, Stress-Strain Curves, Relationship between stress and strain Linear Elastic Materials

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Basic Equations of Elasticity

Equilibrium Equations: Equilibrium of forces in solids, Governing equations of linear elasticity

Compatibility Equations :Strain-displacement relations

Constitutive Relations (Hooke's Law) :Stress-strain relations for isotropic materials, Generalized Hooke's Law for 2D and 3D cases

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Solutions to Elasticity Problems

Plane Stress and Plane Strain Conditions : Application of stress and strain in thin structures

Navier's Equations : Solution of boundary value problems

Torsion of Prismatic Bars : Saint-Venant's Principle

Bending of Beams : Solution of bending stresses in beams

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Strain Energy and Energy Methods in Elasticity

Strain Energy in Elastic Deformation :Work done by external forces, Total strain energy

Energy Methods:Principle of virtual work. Minimum potential energy, Applications to structural analysis

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Introduction to Plasticity

Concepts of Plasticity: Difference between elastic and plastic behaviour, The yield criterion, Flow rule and plastic strain

Plastic Deformation: Uniaxial stress-strain behaviour, Multiaxial stress conditions, Plastic potential

Text Books:

1. Timoshenko, S., & Goodier, J. N. (1970). *Theory of Elasticity* (3rd ed.). McGraw-Hill.

Reference Books:

1. Johnson, R. A. (2004). Introduction to Elasticity and Plasticity. Oxford University Press.
2. Zienkiewicz, O. C., & Taylor, R. L. (2000). The Finite Element Method: Volume 1 - The Basis. Butterworth-Heinemann.
3. Fung, Y. C. (1993). Foundations of Solid Mechanics. Prentice Hall.

NPTEL Links:

1. Theory of Elasticity By Prof. Biswanath Banarjee , IIT Kharagpur https://onlinecourses.nptel.ac.in/noc21_ce45/preview?utm_source=chatgpt.com

THEORY OF ELASTICITY AND PLASTICITY LAB (PCC)					
LAB COURSE CONTENT					
THEORY OF ELASTICITY AND PLASTICITY LAB		**Semester:**	**III**	**Course Code**	**CE – 312A**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

Concerned faculty member should suitably frame **SIX** laboratory assignments from the following list.

LIST OF PRACTICAL- Any **Six** experiments should be performed.

1. **Apply experimental techniques** to measure material properties and study stress Strain Behaviour of Material
2. **Analyze experimental data** to verify theoretical concepts of elasticity and plasticity.
3. **Demonstrate practical knowledge** of deformation under different loading conditions (tension, compression, torsion, and bending).
4. **Identify and interpret the stress-strain behavior** of materials, both in elastic and plastic regimes.

5. **Apply knowledge of plasticity** to analyze the onset of plastic deformation in materials.
6. **Use appropriate equipment and tools** for measuring strain, stress, and deformation in experimental setups.

Text Books:

1. Timoshenko, S., & Goodier, J. N. (1970). *Theory of Elasticity* (3rd ed.). McGraw-Hill.

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

PUBLIC HEALTH STRUCTURES (PCC)					
COURSE OUTLINE					
Course Title:	**PUBLIC HEALTH STRUCTURES**	**Short Title:**	**PHS**	**Course Code:**	**CE - 414A**

Course description:

The course aims at advancing the knowledge in Water Treatment systems and wastewater treatment systems and enhancing the principles of treatment plants design aspects.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**04**
Practical	**02**	**15**	**30**	

Prerequisite course(s): Nil

Course objectives:

The objective of this course is to:

1. Protect Public Health and Environment – Remove harmful pollutants before discharge.
2. Remove Suspended and Dissolved Solids – Improve water clarity and quality.
3. Ensure Public Health Protection
4. Ensure Regulatory Compliance – Follow wastewater discharge norms (e.g., CPCB, EPA).
5. Optimize Treatment Processes – Select cost-effective and energy-efficient treatment methods

Course outcomes:

Upon successful completion of the course, the students will be able to

1. Identify and explain the main physical, chemical and biological processes for water and wastewater treatment.
2. Design basic treatment processes.
3. Develop treatment plant layouts.
4. Design wastewater treatment plant for a industry.
5. Design of various biological treatment process units.

6. Select or construct appropriate treatment schemes to remove certain pollutants present in water or wastewater.
7. Design a water or wastewater treatment component.
8. Learn how to characterize wastewater, and the best available technology (BAT) for physical, chemical and microbiological treatment of wastewater.

COURSE CONTENT			
PUBLIC HEALTH STRUCTURES		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction

Wastewater Sources and flow rates, Characteristics, Standards of Disposal, Treatment Objective and Strategies, Sanitary sewer design, Head works and Preliminary design, Layouts of Primary, Secondary and Advanced Treatment Units. Quantity estimation

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Urban Storm Drainage Design

Introduction to drainage problems in difficult climates. – Planning concepts, Rainfall intensity-duration – Frequency curves. – Design of drainage system elements, – Control of storm water pollution.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Hydraulics of treatment plant

Flow measurement and hydraulic control points – Hydraulic analysis of unit operations – Hydraulic profile through the treatment plant.

Design of screens, grit chamber, skimming tank, and flotation tank. Design of equalization tank, Design of plug flow and complete mix activated sludge process, secondary settling tank, trickling filter, bio tower, rotating biological contactors, sequencing batch reactor, oxidation ditch, and aerated lagoon.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Treatment Plant Design

Design of oxidation ponds, Imhoff tank, septic tank, design of sludge digestion, sludge thickening unit, sludge trying bed, incinerators, Design of anaerobic reactors, Design of anaerobic filter, UASB reactor. Design of disposal system.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Environmental health planning, need for planning, the planning process. Environmental health services, various agencies, international efforts, role of industry, voluntary health agencies, Law and human welfare, public health and the law, constitutional right to healthy environment, environmental education Health aspects of water supply and sanitation, disposal of wastewater in rural and urban areas, integrated approach to health and sanitation.

Text Books:

1. Water and Waste water Technology, Mark J. Hammer, John Willy and Sons, 1986

Reference Books:

1. Benefield L.D. and Randall C.D, Biological Process Designs for Wastewater Treatment, Prentice Hall Pub. Co., 1980
2. Udo Wiesmann, In Su Choi and Eva-Maria Dombrowski, Fundamentals of Biological Wastewater Treatment, 1st Ed., Wiley, 2007
3. Techobanoglous, G. et al, Fifth Edition, Metcalf & Eddy, Inc. Wastewater Engineering: Treatment, Disposal, and Reuse, McGraw-Hill Publishers, New York, 2013.
4. Crittenden, J.C., et al. Water Treatment Principles and Design, 2nd Ed., Montgomery, Inc., John Wiley and Sons, New York, 2005.
5. Reynolds, T.D., Richards, P.A, Unit Operations and Processes in Environmental Engineering, PWS Publishing Company, Boston, 1996
6. Water Supply and Sewerage, E.W. Steel and McGhee, Mc Graw Hill Company, 1979
7. Manual on Water Supply & Treatment, CPHEEO, New Delhi.
8. Metcalf and Eddy, Wastewater Engineering – Collection, Treatment, Disposal and Reuse, 5th Ed., McGraw Hill Pub. Co., 2014
9. Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice McGraw Hill, 2010.

PUBLIC HEALTH STRUCTURES LAB (PCC)					
LAB COURSE CONTENT					
Course Title:	**PUBLIC HEALTH STRUCTURES LAB**	**Short Title:**	**PHS**	**Course Code:**	**CE - 415A**

Teaching Scheme:		**Semester:**	**IV**
		Examination scheme	
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**	**25 marks**
End Semester Exam (ESE) Pattern:		**Oral (OR)**	

Any **eight** experiments should be performed

1. Determination of Physical characteristics of water (pH, Turbidity, electrical conductivity, Solids)
2. Determination of Total Hardness, Calcium Hardness, Magnesium Hardness of water sample
3. Determination of Chlorides, Nitrates, Phosphate and Sulphate of water sample.
4. Determination of Residual chlorine of water sample
5. Study of Jar test for different coagulant dose.
6. Determination of physical characteristics of waste water (pH, Turbidity, colour, solids, temp.)
7. Determination of DO, BOD and COD of waste water sample
8. Determination of oil and grease of waste water sample
9. Determination of Nitrates and Sulphates of waste water sample
10. Determination of Heavy metals from industrial waste

Text Books:

1. Standard methods for the examination of water and wastewater, 21st Edition, Washington: APHA., 2012

Reference Books:

1. Industrial Waste Resource Guidelines Sampling and Analysis of Waters, Wastewaters, Soils and Wastes, EPA Victoria, 2009
2. A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes, Environment Protection Authority State Government of Victoria March 2000
3. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual,

Charotar Publishing House Pvt. Ltd., 1st Ed., 2007

4. Sawyer, C. N., McCarty, P. L., and Perkin, Chemistry for Environmental Engineering and Sci ence, G.F., 5th edition McGraw-Hill Inc., 2002

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY, JALGAON

(M.S.)

Bachelor of Engineering – Honors
in
Sustainability Engineering
for Second Year Bachelor of Engineering
in
Civil
(As per NEP 2020 Guidelines)

Faculty of Science and Technology



SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Honors in Sustainability Engineering

Syllabus Structure for Honors in Sustainability Engineering: Additional Credit (Semester – III)
(w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE - 311B	Environmental legislation in India	PCC	3			3	40	60			100	3
CE - 312B	Environmental legislation in India Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Honors in Sustainability Engineering: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE - 414B	Sustainable Construction Materials	PCC	3			3	40	60			100	3
CE - 415B	Sustainable Construction Materials Lab	PCC			2	2			25	25 (OR)	50	1

ENVIRONMENTAL LEGISLATION IN INDIA (PCC)					
COURSE OUTLINE					
Course Title:	**ENVIRONMENTAL LEGISLATION IN INDIA**	**Short Title:**	**ELI**	**Course Code: Theory**	**CE-311B**

Course description: This course is introduced in Civil engineering to develop the concept of Environmental legislation in India.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The primary objective of this course is to provide students with a comprehensive understanding of the legal framework governing environmental protection and conservation in India. The course aims to:

4. Familiarize students with key environmental laws, policies, and regulations in India.
5. Analyze the role of the judiciary, legislature, and executive in shaping environmental governance.
6. Explore the challenges and opportunities in implementing environmental laws.
7. Equip students with the knowledge to critically evaluate the effectiveness of environmental legislation in addressing contemporary environmental issues.

Course outcomes:

By the end of the course, students will be able to:

1. Students Should Demonstrate a thorough understanding of the constitutional and legal provisions related to environmental protection in India.

2. Students Should critically analyze landmark judicial decisions and their impact on environmental governance.

3. Students Should Apply, Evaluate the effectiveness of environmental policies and legislation in addressing issues such as pollution, biodiversity conservation, and climate change.

4. Students Should Develop informed perspectives on the challenges of enforcement and compliance with environmental laws.

5. Students Should Propose solutions for improving the implementation of environmental legislation in India.

COURSE CONTENT

ENVIRONMENTAL LEGISLATION IN INDIA		**Semester:**	**III**	**Course Code**	**CE-311B**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures:** 09 Hours	**Marks:** 12

Introduction to Environmental Legislation in India

- Historical evolution of environmental laws in India.
- Constitutional provisions: Article 48A, Article 51A(g), and Directive Principles of State Policy.
- Role of the judiciary in environmental protection: Public Interest Litigation (PIL) and judicial activism.
- The Water (Prevention and Control of Pollution) Act, 1974.
- The Air (Prevention and Control of Pollution) Act, 1981.
- The Environment (Protection) Act, 1986.
- The Wildlife Protection Act, 1972.
- The Forest (Conservation) Act, 1980.
- The Biological Diversity Act, 2002.
- The National Green Tribunal Act, 2010.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

International Environmental Agreements and Their Influence on Indian Legislation

- Stockholm Declaration, 1972.
- Rio Earth Summit, 1992, and Agenda 21.
- Paris Agreement, 2015.
- Convention on Biological Diversity (CBD) and its implementation in India.

Role of international treaties in shaping domestic environmental laws

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Judicial Pronouncements and Landmark Cases

- M.C. Mehta vs. Union of India (Ganga Pollution Case).
- Vellore Citizens Welfare Forum vs. Union of India (Sustainable Development and Precautionary Principle).
- T.N. Godavarman Thirumulpad vs. Union of India (Forest Conservation Case).
- Indian Council for Enviro-Legal Action vs. Union of India (Polluter Pays Principle).

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

- Enforcement and compliance issues.
- Conflict between development and environmental conservation.
- Role of public participation and environmental awareness.
- Climate change and its legal implications in India.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Emerging Issues and Future Directions

- E-waste management and legislation.
- Plastic waste management rules.
- Renewable energy policies and their legal framework.
- Urban environmental challenges and smart city initiatives.

Text Books:

1. A Textbook of **Environmental Law and Policy in India** by Shyam Divan and Armin Rosencranz..

Reference Books:

1. **Environmental Jurisprudence in India** by S.C. Shastri,
2. **Environmental Jurisprudence in India**, by S.C. Shastri,
3. Reports and publications by the Ministry of Environment, Forest and Climate Change

(MoEFCC).

4 Relevant judgments and case laws from the Supreme Court of India and National Green Tribunal.

5. A Textbook of **Environmental Law in India** by P. Leelakrishnan

NPTEL Links:

1. https://youtu.be/iV-BvYwl4Y8

ENVIRONMENTAL LEGISLATION IN INDIA LAB					
LAB COURSE CONTENT					
ENVIRONMENTAL LEGISLATION IN INDIA LAB		**Semester:**	**III**	**Course Code**	**CE-312B**
Teaching Scheme:		**Examination scheme**			
Assignment :	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**		**25 Marks**	
		End Semester Exam (ESE) UA:		**25 Marks (OR)**	
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

LIST OF ASSIGNMENT - Any seven Assignments should be performed.

(i) **Introduction to Environmental Legislation in India**

- Overview of key environmental laws (e.g., Environment Protection Act, Water Act, Air Act, Wildlife Protection Act, Forest Conservation Act).
- Discussion on the constitutional framework for environmental protection.
- Activity: Group discussion on the importance of environmental legislation.

(ii) **Environment Protection Act, 1986**

- Analysis of the provisions and objectives of the EPA.
- Case Study: Implementation of EPA in industrial pollution control.
- Activity: Role-play simulating a public hearing for an industrial project

(iii) **Water (Prevention and Control of Pollution) Act, 1974**

- Study of water quality standards and regulatory mechanisms.
- Field Visit: Visit to a local water treatment plant or polluted water body.
- Activity: Water sampling and analysis (basic parameters like pH, turbidity, dissolved

oxygen

(iv) **Air (Prevention and Control of Pollution) Act, 1981**

- Understanding air quality standards and monitoring systems.
- Case Study: Air pollution in urban areas (e.g., Delhi's air quality crisis).
- Activity: Air quality monitoring using portable devices

(v) **Forest Conservation Act, 1980**

- Study of forest rights and conservation policies.
- Case Study: Impact of deforestation on tribal communities.
- Activity: Debate on forest conservation vs. development projects.

(vi) **Biodiversity Act, 2002**

- Understanding biodiversity conservation and sustainable use.
- Activity: Group presentation on traditional knowledge and biodiversity

(vii) **E-Waste Management Rules, 2016**

- Understanding e-waste disposal and recycling mechanisms.
- Field Visit: Visit to an e-waste recycling facility.
- Activity: Survey on e-waste awareness among students.

(viii) **Environmental Impact Assessment (EIA)**

- Study of the EIA process and its significance.
- Case Study: Controversial projects and EIA violations.
- Activity: Preparing a mock EIA report for a hypothetical project.

Text Books:

1. Textbook of "Environmental Studies: From Crisis to Cure" by R. Rajagopalan
2. Reports and publications from the Ministry of Environment, Forest and Climate Change (MoEFCC).

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal.

Evaluation will be based on oral, paper work and performance in the ESE.

SUSTAINABLE CONSTRUCTION MATERIALS					
COURSE OUTLINE					
Course Title:	**SUSTAINABLE CONSTRUCTION MATERIALS**	**Short Title:**	**SCM**	**Course Code: Theory**	**CE-414B**
Course description: This course is introduced in Civil engineering to develop the concept of fluid properties, fluid statics and dynamics.					

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The primary objectives of this course are to:

1. Introduce students to the concept of sustainability in construction and the role of materials in achieving sustainable development goals.
2. Provide an understanding of the environmental, social, and economic impacts of construction materials.
3. Explore innovative and eco-friendly materials and technologies used in sustainable construction.
4. Develop the ability to evaluate and select materials based on their sustainability performance.
5. Encourage critical thinking about the lifecycle assessment (LCA) of construction materials.
6. Promote awareness of global standards, certifications, and policies related to sustainable construction materials.

Course outcomes:

By the end of this course, students will be able to:

1. **Students should Understand** the principles of sustainability and their application in construction materials.
2. **Students should Identify** and **classify** sustainable construction materials and their properties.
3. **Students should Analyze** the environmental impact of traditional and alternative construction materials using tools like Life Cycle Assessment (LCA).
4. **Students should Apply and Evaluate** the performance of sustainable materials in terms of durability, energy efficiency, and cost-effectiveness.
5. **Students should Design** construction projects incorporating sustainable materials and practices.
6. **Students should Discuss** global trends, certifications (e.g., LEED, BREEAM), and policies promoting sustainable construction

COURSE CONTENT

SUSTAINABLE CONSTRUCTION MATERIALS		**Semester:**	**IV**	**Course Code**	**CE-414B**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Sustainable Construction Materials

- Definition and importance of sustainable construction
- Principles of sustainability: Environmental, Social, and Economic (Triple Bottom Line)
- Overview of sustainable development goals (SDGs) related to construction
- Challenges in adopting sustainable materials

Traditional vs. Sustainable Construction Materials

- Comparison of conventional materials (e.g., concrete, steel) with sustainable alternatives
- Environmental impact of traditional materials (carbon footprint, resource depletion)
- Case studies on the use of sustainable materials in construction

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Eco-Friendly Construction Materials

- Recycled and reclaimed materials (e.g., recycled concrete, reclaimed wood)
- Bio-based materials (e.g., bamboo, hempcrete, mycelium)
- Low-carbon materials (e.g., geopolymer concrete, fly ash bricks)
- Innovative materials (e.g., self-healing concrete, photovoltaic glass)

Life Cycle Assessment (LCA) of Construction Materials

- Introduction to LCA methodology
- Stages of LCA: Extraction, production, transportation, use, and disposal
- Tools and software for LCA (e.g., SimaPro, GaBi)
- Case studies on LCA of construction materials

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Energy-Efficient and Smart Materials

- Materials for energy efficiency (e.g., insulated concrete forms, phase-change materials)
- Smart materials (e.g., thermochromic glass, shape-memory alloys)
- Integration of renewable energy systems in construction

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Sustainable Material Standards and Certifications

- Overview of green building certifications (e.g., LEED, BREEAM, Green Star)
- Material selection criteria for certifications
- Global policies and regulations promoting sustainable construction

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Future Trends in Sustainable Construction Materials

- Nanotechnology in construction materials
- 3D printing with sustainable materials
- Circular economy and zero-waste construction
- Research and development in sustainable materials

Text Books:

1. A Textbook of **"Sustainable Construction Materials: Life Cycle Assessment"** by Ravindra K. Dhir.

Reference Books:

1. **"**Materials for Sustainable Sites: A Complete Guide to the Evaluation, Selection, and

Use of Sustainable Construction Materials" by Meg Calkins.

2. Research papers and articles from journals like Journal of Cleaner Production and Building and Environment
3. **"Green Building Materials: A Guide to Product Selection and Specification"** by Ross Spiegel and Dru Meadows.

NPTEL Links:

1..https://youtu.be/9hfKdUGWQjQ

SUSTAINABLE CONSTRUCTION MATERIALS LAB (PCC)					
LAB COURSE CONTENT					
SUSTAINABLE CONSTRUCTION MATERIALS LAB		**Semester:**	**IV**	**Course Code**	**CE-415B**
Teaching Scheme:		**Examination scheme**			
Assignment :	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**		**25 Marks**	
		End Semester Exam (ESE) UA:		**25 Marks (OR)**	
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

LIST OF ASSIGNMENT - Any seven Assignments should be performed.

(i) **Introduction to Sustainable Construction Materials**

- Overview of sustainability in construction.
- Key concepts: Life Cycle Assessment (LCA), Embodied Energy, Carbon Footprint.
- Lab: Introduction to lab equipment and safety protocols.

(ii) **Sustainable Concrete Alternatives**

- Fly ash, slag, geopolymers, and recycled aggregates.
- Lab: Testing compressive strength of sustainable concrete mixes

(iii **Eco-Friendly Bricks and Masonry**

- Compressed earth blocks, hempcrete, and recycled brick materials.
- Lab: Testing thermal conductivity and compressive strength of eco-bricks.

(iv) **Sustainable Pavement Materials**

- Porous asphalt, recycled rubber, and bio-based binders.

- Lab: Testing permeability and durability of sustainable pavements
-

(v) **Life Cycle Assessment (LCA) of Materials**

- Introduction to LCA software and tools.
- Lab: Conducting a simplified LCA for a construction material.

(vi) Innovations in Sustainable Materials

- Self-healing concrete, mycelium-based materials, and 3D-printed structures.
- Lab: Exploring innovative materials and their applications.

(Vii) Group Project Presentations

- Students present their findings on a sustainable material or application.
- Peer review and feedback.

(Viii)Field Trip (Optional)

- Visit to a sustainable construction site or material manufacturing facility..

Text Books:

1. "Sustainable Construction Materials: Life Cycle Assessment" by Ravindra K. Dhir.

References:

1. "Green Building Materials: A Guide to Product Selection and Specification" by Ross Spiegel and Dru Meadows.
2. Online resources: US Green Building Council (USGBC), International Living Future Institute (ILFI).

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY, JALGAON
(M.S.)

Bachelor of Engineering – Honors
in
Construction Technology
for Second Year Bachelor of Engineering
in
Civil
(As per NEP 2020 Guidelines)

Faculty of Science and Technology



SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Honors in Construction Technology

Syllabus Structure for Honors in Construction Technology: Additional Credit (Semester – III) (w.e.f. 2025 – 26) (As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical			
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)	Total	
CE - 311C	Project Management	PCC	3			3	40	60			100	3
CE - 312C	Project Management Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Honors in Construction Technology: Additional Credit (Semester – IV) (w.e.f. 2025 – 26) (As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical			
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)	Total	
CE - 414C	Cost and Quality Management	PCC	3			3	40	60			100	3
CE - 415C	Cost and Quality Management Lab	PCC			2	2			25	25 (OR)	50	1

PROJECT MANAGEMENT (PCC)					
COURSE OUTLINE					
Course Title:	**PROJECT MANAGEMENT**	**Short Title:**	**PM**	**Course Code: Theory**	**CE-311C**

Course description: This course is introduced in Civil engineering to develop the concept of quality control on various activities on Construction project work.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The general objective of course is to develop the concept of Project management awareness on project construction activities and its application. Civil engineering mostly related with construction works. This general objective is classified in specific objectives as follows:

1. Concept of proper management on project.
2. Monitoring the project activities
3. Quality Control

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply the knowledge of mathematics and science to develop, engineering fundamental concept of project cost, cash flow, bill of quantities.

2. Understand the concept of management and control the man power, equipment etc

3. Analyze societal, health, safety, legal and cultural issues and the consequent responsibilities as a professional engineering practice in the field of big construction project.

4. Evaluate effectively on complex engineering activities with the engineering community and with society at large in concern with quality assurance and its engineering application.

5. Create a need of lifelong leadership quality, assurance and its control for successful

completion of project on scheduled time frame.

COURSE CONTENT

PROJECT MANAGEMENT		**Semester:**	**III**	**Course Code**	**CE-311C**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures:** 09 Hours	**Marks:** 12

Project management in Construction Industry: types of construction for building, commercial, infrastructural & refineries, Construction team members & their role, Stages in project management, Need of management in construction, Role and function of construction Project Manager, Job layout requirement before commencement of any project, concept of mass housing and value engineering.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Network Technique: Bar Charts, S- Curve, Concept of Critical Path Method (CPM), various terms used in networks, Development of network, Network scheduling, to find various times and float. EST, EFT, LST, LFT and TF.

Programme Evaluate Review Technique (PERT) its concept and PERT time. Comparison of CPM and PERT ; its suitability

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Cost analysis, Cost curve, optimization and crashing of network, Line of Balance (LOB), Resource leveling & its allocation.

Engineering Economics: definition and its importance, concept of demand & supply, concept of term Cost, Price and Value. Fund raised from Financial institute like banks, world banks its function and banking system. Importance of Micro & Macro-economics.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Construction equipment & its management: Excavating equipment: power shovel, drag lines,

Hoes and Clamp shell. Compacting Equipment: Pneumatic tyre roller, Sheep Foot roller.

Hoisting Equipment : mobile crane, Tower Crane, Hydraulic crane, Gantry crane

Ready Mix Concrete Plants (RMC): Central and Portable concrete batching plant; study of Concrete pumps delivering concrete at heights.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Safety Management on Construction Project: Safety measures for i. excavation work. ii. For working at heights iii. For building demolition works iv. Hot bituminous works v. for safety crane operation work. Importance of safety audit on construction project.

Entrepreneurship Development in Construction Field: concept and its importance.

Text Books:

1. A Textbook of Construction Planning & project costing by Dr. R. L. Peurifoy, Laxmi Publication.

Reference Books:

1.Construction management, Dr. Mahesh Verma, Standard Book House

2. Construction Planning and management Dr. U. K. Srivastava, Tata McGraw Hill

3. Indian Economy: Mishra- Puri, Himalaya publication ltd.

4. Entrepreneurship Development in India-Gupta, Srivivasan- Sultan Chand & Sons

5. A Textbook of Construction Engineering & Management by S C Sharma, Khanna Publication.

6.Costruction Project Management by Kumar Neeraj Zha, PEARSON – Delhi

NPTEL Links:

1. https://youtu.be/ILhX4xVcxk0 " Resource level & is orientation" by Prof.Sudhir Misra IIT Kanpur
2. https://youtu.be/ypTiYyh7YT0 By Prof Sudhir Misra, IIT Kanpur
3. https://youtu.be/Bh_LYZh3KH4 " Construction Safety management" By Prof. Sudhir Misra, IIT Kanpur

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<tr><td colspan="3">End Semester Exam (ESE) UA:</td><td>25 Marks (OR)</td></tr>
<tr><td colspan="2">End Semester Exam (ESE) Pattern:</td><td colspan="4">Oral (OR)</td></tr>
<tr><td colspan="6">LIST OF PRACTICAL- Any two experiments should be performed.

(I) Task: To visit the medium size Construction project ; following information to be compiled briefly

i. To know the responsibilities of the stake holders like.. Architect, Structural consultant, Construction manager in project. Organization chart, type of project its cost & completion date

ii. To study material management, storage of material , inventory

iii. To study the receipt and issue of the material to the vendor

iv. To study the system of indent for ordering material

v. To study the QA QC Policy and its audit

vi. To study the preparing of contractors billing system and its submission procedure.

II. To study the plant and equipment used for the project

i. To study & collect the data for equipment output with efficiency

ii. Availability of spare parts and its cost

iii. To study payment analysis of machinery

III. To visit the local RMC plant

i. To know the system of issuing concrete mix and its delivery at spot

ii. Noting of plant capacity, number of Transit Mixer and its capacity.</td></tr>
</table>

IV. To visit the Stone Crusher

i. To note the type of crusher (whether primary or secondary crusher)

ii. System of stone size distribution and its collection system

iii. To analysis the cost of producing the various size stone.

Text Books:

1. Textbook of Building Construction by Sushi Kumar, Laxmi Publications
2. A Textbook of Construction Engineering & Management by S C Sharma, Khanna Publication

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

COST AND QUALITY MANAGEMENT (PCC)					
COURSE OUTLINE					
Course Title:	**COST AND QUALITY MANAGEMENT**	**Short Title:**	**CQM**	**Course Code: Theory**	**CE-414C**

Course description: This course is introduced in Civil engineering to develop the concept of quality control on various activities on Construction project work.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The general objective of course is to develop the concept of Quality awareness on project construction activities and its application. Civil engineering mostly related with construction works. This general objective is classified in specific objectives as follows:

1. Concept of Quality awareness on project.
2. Quality Assurance
3. Quality Control

Course outcomes:

After successful completion of this course the student will be able to:

1. Apply the knowledge of mathematics and science to develop, engineering fundamental concept of properties of various construction materials.

2. Understand the concept of Quality analysis in different types of construction materials.

3. Analyze societal, health, safety, legal and cultural issues and the consequent responsibilities as a professional engineering practice in the field of big construction project.

4. Evaluate effectively on complex engineering activities with the engineering community and with society at large in concern with quality assurance and its engineering application.

5. Create a need of lifelong learning in quality assurance and its control and its application in Civil engineering work.

COURSE CONTENT					
COST AND QUALITY MANAGEMENT		**Semester:**	**IV**	**Course Code**	**CE-414C**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Cost : definition, it various types, Benefit/ Cost/ [B / C] ratio, element of cost, direct cost, indirect cost, fixed and variable head, owning cost, depreciation,, determination of owning and operating costs, break-even point and its theory.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Project Cost Management: cost planning, cost budgeting, cost control, cost collection related information: labour cost, material cost, plant and equipment cost, overhead cost, cost codes and its statement and its summary on project.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Function of financial Management: Capital fixed or block capital, working capital, responsibilities of financial management, financial planning, methods of Financing, capital investment decisions.

Cost control and cost reduction. Skill to know cost saving areas in project.

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Quality Management: Concept of term Quality Assurance and Quality control, Supervision : Stages and measures of control, sample and sampling technique.

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction of ISO 9000 and ISO 14000, Essentials elements of Total Quality Management (TQM), Quality Audit and its types

Text Books:

1. A Textbook of Construction Planning & project costing by Dr. R. L. Peurifoy, Laxmi Publication..

Reference Books:

1.Construction management, Dr. Mahesh Verma, Standard Book House

2. Construction Planning and management Dr. U. K. Srivastava, Tata McGraw Hill

3. A Textbook of Construction Engineering & Management by S C Sharma, Khanna Publication

NPTEL Links:

1. https://youtu.be/OCQWORauftk By Prof. Sudhir Misra , IIT Kanpur
2. https://youtu.be/ypTiYyh7YT0 By Prof Sudhir Misra, IIT Kanpur
3. http://digimat.in/nptel/courses/video/105107121/L01.html by Prof. S K Ghosh ,IIT Roorkee

COST AND QUALITY MANAGEMENT LAB (PCC)					
LAB COURSE CONTENT					
COST AND QUALITY MANAGEMENT LAB		**Semester:**	**IV**	**Course Code**	**CH –415C**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

LIST OF PRACTICAL- Any **six** experiments should be performed.

(i) Task: To Collect the local Material and Labour rates for building Construction.

(ii) Rate Analysis for Bricks manufacturing

(iii) Rate Analysis for Concrete Block manufacturing

(iv) Rate Analysis for Concrete Doors and windows manufacturing

(v) Rate Analysis for Concrete Man hole Cover, small concrete box culvert manufacturing

(vi) To implement the Quality Control policy for Construction of Brick masonry in local housing

project

(vii) To implement the Quality Control policy for Construction of internal and External cement mortar plaster in local housing project

(viii) Setting Quality Audit programme on any local project.

Text Books:

1. Textbook of Building Construction by Sushi Kumar, Laxmi Publications
2. A Textbook of Construction Engineering & Management by S C Sharma, Khanna Publication

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

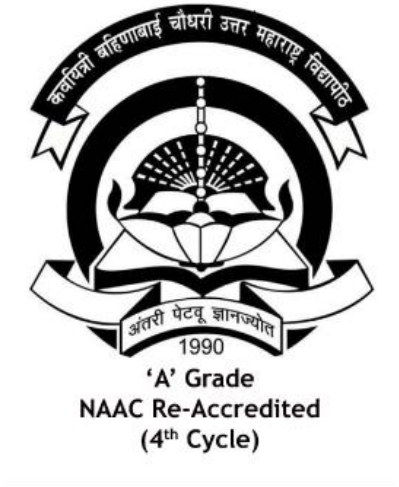
Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Bachelor of Engineering – Minor
in
Sustainability and Industrial Pollution Control
for Second Year Bachelor of Engineering
offered by
Civil
(As per NEP 2020 Guidelines)

Faculty of Science and Technology



SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Specialization Minor in Sustainability and Industrial Pollution Control

Syllabus Structure for Specialization Minor in Sustainability and Industrial Pollution Control
Additional Credit (Semester – III) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-313A	Water Treatment Operations and Processes	PCC	3			3	40	60			100	3
CE-314A	Water Treatment Operations and Processes Lab	PCC			2	2			25	25 (OR)	50	1

Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-416A	Biochemical Processes for Wastewater Treatment	PCC	3			3	40	60			100	3
CE-417A	Biochemical Processes for Wastewater Treatment lab	PCC			2	2			25	25 (OR)	50	1

WATER TREATMENT OPERATION AND PROCESSES (PCC)					
COURSE OUTLINE					
Course Title:	**WATER TREATMENT OPERATION AND PROCESSES**	**Short Title:**	**WTOP**	**Course Code: Theory**	**CE-313A**

Course description: This course provides an in-depth understanding of the principles, operations, and processes involved in water treatment t. It covers he physical, chemical, and biological methods used to treat water for potable and industrial use. Students will learn about water quality standards, technologies treatment, and the operational aspects of water treatment plants.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

Upon successful completion of this course, students will:

1. Demonstrate filtration, and disinfection.
2. Interpret water quality data and knowledge of water treatment processes, including coagulation, flocculation, sedimentation apply it to optimize treatment processes.
3. Operate and maintain treatment equipment used in water plants

Course outcomes:

1. Understand the sources and characteristics of raw water and the importance of water treatment
2. Explain the physical, chemical, and biological processes used in water treatment.
3. Analyze water quality parameters and their significance in treatment processes.
4. Operate and maintain key components of a water treatment plant.
5. Evaluate the efficiency of water treatment processes and troubleshoot common operational issues.

COURSE CONTENT					
WATER TREATMENT OPERATION AND PROCESSES		**Semester:**	**III**	**Course Code**	**CE – 313A**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**

	Internal Sessional Exam (ISE) CA:	**40 marks**
Unit–I:	**No. of Lectures:** 09 Hours	**Marks:** 12
Introduction to Water Treatment Available water sources, Importance of water treatment, Sources of raw water and their characteristics, Overview of water quality standards and regulations ,Water Quality Parameters, Physical, chemical, and biological parameters, Water sampling and analysis techniques Interpreting water quality data		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Physical Treatment Processes Screening and sedimentation, Filtration methods (rapid sand, slow sand, membrane filtration) floation, Aeration, Chemical Treatment Processes: Coagulation and flocculation, methods (chlorination, ozonation, UV treatment, declorination, factors affecting disinfection process) Chemical dosing and control**,** oxidation process , softening method , chemical precipitation method.		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Biological Treatment Processes*,* Fundamentals of Biological Water Treatment , Overview of biological treatment processes, role of microorganisms in water treatment**,** Types of microorganisms involved (bacteria, fungi, algae, protozoa) Aerobic Biological Treatment Processes **,**Activated sludge process**,** Trickling filters**,** Rotating biological contactors (RBCs) Anaerobic Biological Treatment Processes**,** Anaerobic digestion**,** Anaerobic filters, Anaerobic lagoons		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Advanced Treatment Technologies: Reverse osmosis and desalination, advanced oxidation processes, Removal of emerging contaminants (e.g., pharmaceuticals, micro plastics) Water Treatment Plant Operations, Plant layout and design, Operational best practices, Maintenance and troubleshooting, Emerging Technologies: Nano Technology, artificial intelligence (AI)		
Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Water Quality Monitoring and Analysis**:** Water Sampling and Analytical Techniques, Real-Time Monitoring Systems .Data Interpretation and Reporting

Case Studies and Applications: Industrial Water Treatment, Municipal Water Treatment, Reuse and Recycling of Wastewater, Global Case Studies on Advanced Water Treatment Projects

Text Books:

1. Water Supply Engineering by Dr.B.C. Punmia, Ashok Kr.Jain, Arun Kr.jain,Firewall media publication

Reference Books:

1**."**Introduction to Water Treatment**"** by C. Binnie and M. Kimber.

2. Water Quality and Treatment: A Handbook on Drinking Water" by American Water Works Association (AWWA).

3. "Water Treatment: Principles and Design" by MWH (John Wiley & Sons)

NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc23_ce12/preview By Prof. Bhanu Prakash vellanki , IIT Roorkee

2. https://archive.nptel.ac.in/courses/105/105/105105201/ by Prof. Manoj Kumar Tiwari ,IIT Kharagpur

WATER TREATMENT OPERATION AND PROCESSES LAB					
WATER TREATMENT OPERATION AND PROCESSES LAB		**Semester:**	**III**	**Course Code**	**CE – 314A**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			
LIST OF PRACTICAL- Any **seven** experiments should be performed.					

(i) To determine of PH and alkalinity of water sample.

(ii) To determination of turbidity of water and determine optimum coagulant dose using jar test apparatus.

(iii) To determine chlorine content of given water sample by titration method.

(iv) To determine hardness of water.

(v) To determine MPN of water sample.

(vi) To Determine DO content of water sample.

(vii) To determine oil/grease of the water sample.

(viii) To determine total solids, dissolved solids, and suspended solids of the water sample.

(ix) To determine the floc formation form given water sample.

Text Books:

1. Water Quality and Treatment: A Handbook on Drinking Water" by American Water Works Association (AWWA)

2. Standard Methods for examination of water and wastewater, APHA Publication.

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

BIOCHEMICAL PROCESSES FOR WASTEWATER TREATMENT (PCC)					
COURSE OUTLINE					
Course Title:	**BIOCHEMICAL PROCESSES FOR WASTEWATER TREATMENT**	**Short Title:**	**BPWT**	**Course Code: Theory**	**CE-416A**

Course description: This course explores the biochemical processes involved in the treatment of wastewater. Topics will include microbial metabolism, nutrient cycling, biological treatment processes, and system design. Students will learn the principles of biological wastewater treatment, including aerobic and anaerobic processes, and will apply these principles to real-world treatment systems.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

This course aims to provide a comprehensive understanding of biochemical processes in wastewater treatment, equipping students with the knowledge and skills to design, operate, and optimize biological treatment systems for effective wastewater management and resource recovery.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the biochemical and microbiological principles of wastewater treatment.
2. Analyze and design biological treatment systems.
3. Identify and apply different biological processes in the treatment of wastewater.
4. Interpret kinetic models and performance parameters for biological systems.
5. Design effective strategies for nutrient removal and energy recovery.

COURSE CONTENT

BIOCHEMICALPROCESSES FOR WASTEWATER TREATMENT		**Semester:**	**IV**	**Course Code**	**CE – 416A**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures:** 09 Hours	**Marks:** 12
Introduction to Wastewater Treatment and Biochemical Processes: Overview of wastewater treatment, Types of wastewater (domestic, industrial, storm water), Basic principles of biochemical processes in wastewater treatment, Microbial ecology and the role of microorganisms in wastewater treatment. Microbiology of Wastewater Treatment: Types of microorganisms in wastewater (bacteria, protozoa, fungi, etc.), Microbial metabolism: aerobic, anaerobic, and facultative processes.		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD): Definition and significance of BOD and COD, Measurement techniques for BOD and COD, Relationship between BOD, COD, and wastewater treatment performance. Aerobic Biological Treatment Processes: Activated sludge process, Trickling filters and rotating biological contactors (RBCs), Design principles for aeration tanks, Kinetics of aerobic microbial growth.		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Advanced Biological Treatment Systems: Membrane bioreactors (MBRs), Moving bed biofilm reactors (MBBRs), Comparison of performance and application Nutrient Removal in Wastewater Treatment: Nitrogen removal: nitrification and denitrification processes, Phosphorus removal and biological phosphorus removal (BPR), Process control and optimization for nutrient removal. Wastewater Treatment System Modeling and Kinetics: Overview of mathematical modeling in biological treatment system, Michaelis-Menten kinetics in wastewater treatment.		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Sludge Management and Stabilization: Sludge production in biological treatment, Sludge stabilization methods (aerobic, anaerobic, lime stabilization), Dewatering and disposal methods for treated sludge. Systems and Energy Recovery: Combining aerobic and anaerobic systems, Resource recovery:		

biogas production, nutrient recovery, Energy-positive wastewater treatment systems, and the role of bioenergy in sustainable wastewater treatment.

Unit–V	**No. of Lectures: 09 Hours**	**Marks: 12**

Environmental and Regulatory Considerations: Environmental impact of wastewater treatment processes. Regulatory standards for wastewater effluent quality (BOD, COD, TSS, nutrient levels)

Emerging Technologies in Wastewater Treatment: Algal-based treatment systems, Electrochemical treatment processes, Recent research and innovations in biochemical treatment, Review of key concepts, models, and design techniques, Discussions on future trends in wastewater treatment.

Text Books:

1. "Wastewater Treatment: Biological and Chemical Processes" by Author: Syed R. Qasim (2nd Edition, 2000)
2. Wastewater Treatment By SJ Arceiwala, ShyamAsolekar, TMH Publications.

Reference Books:

1. P. F. Stanbury, A. Whitaker and S. J. Hall, Principles of fermentation technology Aditya book
2. CPHEEO Manual on Water Supply, Urban Development Authority
3. CPHEEO Manual on Wastewater, 1993, Urban Development Authority

NPTEL Links:

1. https://archive.nptel.ac.in/courses/103/107/103107217/ By Prof. V.C. Srivastav, IIT Rookee
2. https://archive.nptel.ac.in/courses/105/105/105105178/ by Prof. M.K.Tiwari ,IIT Kharagpur.

<table>
<tr><th colspan="6">BIOCHEMICALPROCESSES FOR WASTEWATER TREATMENT LAB (PCC)</th></tr>
<tr><th colspan="6">COURSE CONTENT</th></tr>
<tr><td colspan="2">BIOCHEMICALPROCESSES FOR WASTEWATER TREATMENT LAB</td><td>Semester:</td><td>III</td><td>Course Code</td><td>CE – 417A</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td rowspan="2">Practical:</td><td rowspan="2">2 hours/week</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 Marks</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) UA:</td><td>25 Marks (OR)</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) Pattern:</td><td colspan="3">Oral (OR)</td></tr>
<tr><td colspan="6">LIST OF PRACTICAL- Any seven experiments should be performed.
(i) Measurement of viscosity
(ii) Study of Pressure Measuring Devices
(iii) Stability of Floating Body
(iv) Reynolds Experiment
(v) Verification of Bernoulli’s Theorem
(vi) Venturimeter
(vii) Coefficient of Orifice
(viii) Impacts of jets</td></tr>
<tr><td colspan="6">Guide lines for ICA:</td></tr>
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</table>

Kavayitri Bahinabai Chaudhari NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Bachelor of Engineering – Minor
in
Structural Design
for Second Year Bachelor of Engineering
offered by
Civil
(As per NEP 2020 Guidelines)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
(4th Cycle)

SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Specialization Minor in Structural Design

Syllabus Structure for Specialization Minor in Structural Design: Additional Credit (Semester – III) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical			
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)	Total	
CE-313B	Elements of Structural Analysis	PCC	3			3	40	60			100	3
CE-314B	Elements of Structural Analysis Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Specialization Minor in Structural Design: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)
(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical			
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)	Total	
CE-416B	Advanced Structural Analysis	PCC	3			3	40	60			100	3
CE-417B	Advanced Structural Analysis Lab	PCC			2	2			25	25 (OR)	50	1

ELEMENTS OF STRUCTURAL ANALYSIS (PCC)					
COURSE OUTLINE					
Course Title:	**ELEMENTS OF STRUCTURAL ANALYSIS**	**Short Title:**	**ESA**	**Course Code: Theory**	**CE-313B**

Course description: This course is introduced in Civil engineering to develop the concept of structural elements, fundamental concept of structural analysis.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The primary objective of this course is to introduce students to the fundamental principles and methods of structural analysis. Students will learn how to analyze and predict the behavior of structures under various loading conditions. The course aims to develop the ability to model, analyze, and design structural systems using both classical and modern analytical techniques. By the end of the course, students should be able to apply these principles to real-world engineering problems.

Course outcomes:

After successful completion of this course the student will be able to:

1. Students should understand the basic concepts of structural analysis, including equilibrium, compatibility, and material behavior.
2. Students should analyze determinate and indeterminate structures using classical methods such as the method of joints, method of sections, and moment distribution.
3. Students should apply energy methods, including virtual work and Castigliano's theorems, to solve structural problems
4. Students should evaluate the influence lines for beams and trusses and apply them to moving loads.
5. Students should use matrix methods for the analysis of structures, including stiffness and flexibility methods.
6. Students should develop computational skills to solve complex structural problems using software tools.
7. Students should design and optimize structural systems based on analytical results and engineering judgment.

COURSE CONTENT

ELEMENTS OF STRUCTURAL	**Semester:**	**III**	**Course**	**CE-313B**

ANALYSIS				**Code**	
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			60 marks
		Duration of ESE:			03 hours
		Internal Sessional Exam (ISE) CA:			40 marks
Unit–I:	**No. of Lectures:** 09 Hours		**Marks:** 12		

Introduction to Structural Analysis

Definition and scope of structural analysis, Types of structures: beams, trusses, frames, and cables, Types of loads: static, dynamic, and environmental, Equilibrium, compatibility, and constitutive relationships

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Analysis of Determinate Structures

Analysis of statically determinate beams and frames, Method of joints and method of sections for trusses, Shear force and bending moment diagrams, Deflection of beams using double integration and moment-area methods

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Analysis of Indeterminate Structures

Introduction to statically indeterminate structures, Force method: flexibility coefficients and compatibility equations, Slope-deflection method, Moment distribution method

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Energy Methods

Principle of virtual work, Castigliano's theorems, Application to beams, trusses, and frames

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Influence Lines

Concept of influence lines for beams and trusses, Moving loads and absolute maximum

moment,Application of influence lines in design
Text Books:
1. A Textbook of "Structural Analysis" by R.C. Hibbeler
Reference Books: 1. "Theory of Structures" by S. Ramamrutham 2. "Structural Analysis: In Theory and Practice" by Alan Williams 3. "Matrix Analysis of Structures" by Aslam Kassimali 4. A Textbook of Structural Analysis: A Classical and Matrix Approach" by Jack C. McCormac and James K. Nelson
NPTEL Links: 1. https://onlinecourses.nptel.ac.in/noc24_ce31/preview by Prof. Amit Shaw, IIT Kharagpur

ELEMENTS OF STRUCTURAL ANALYSIS LAB					
LAB COURSE CONTENT					
ELEMENTS OF STRUCTURAL ANALYSIS LAB		**Semester:**	**III**	**Course Code**	**CE-314B**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			
LIST OF ASSIGNMENTS- Any **seven** assignments should be performed. (i) Tension Test on Steel Rods (ii) Compression Test on Concrete Cylinders (iii) Bending Test on Simply Supported Beams (iv) Torsion Test on Circular Shafts (v) Buckling Test on Columns (vi) Influence Lines for Beams (vii) Truss Analysis					

(viii) Deflection of Cantilever Beams
Text Books:
1. Textbook of "Structural Analysis" by R.C. Hibbeler (Pearson Education).
Guide lines for ICA:
Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.
Guide lines for ESE:
ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

ADVANCED STRUCTURAL ANALYSIS (PCC)					
COURSE OUTLINE					
Course Title:	**ADVANCED STRUCTURAL ANALYSIS**	**Short Title:**	**ASA**	**Course Code: Theory**	**CE-416 B**

Course description: Advanced Structural Analysis is a specialized subject that focuses on the analysis of complex structural systems, extending beyond the basic concepts taught in introductory courses. It involves understanding the behavior of structures under various loads, utilizing advanced methods to predict and calculate stresses, displacements, and internal forces in structural components.

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The primary objective of this course is to provide students with an in-depth understanding of advanced concepts and techniques in structural analysis. The course aims to equip students with the skills to analyze complex structural systems, including indeterminate structures, dynamic systems, and nonlinear behavior. Emphasis will be placed on both theoretical foundations and practical applications, enabling students to solve real-world engineering problems using modern analytical and computational tools.

Course outcomes:

After successful completion of this course the student will be able to:

1. Students should analyze indeterminate structures using advanced methods such as the matrix method, flexibility method, and stiffness method.
2. Students should evaluate the dynamic response of structures subjected to time-varying loads, including seismic and wind loads.
3. Students should understand and apply nonlinear analysis techniques for structures undergoing large deformations or material nonlinearity.
4. Students should utilize computational tools and software for structural modeling and analysis.
5. Students should design and optimize structural systems considering stability, load distribution, and failure mechanisms.
6. Students should interpret and validate analytical results with practical applications.

COURSE CONTENT

ADVANCED STRUCTURAL ANALYSIS		**Semester:**	**IV**	**Course Code**	**CE-416 B**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures:** 09 Hours	**Marks:** 12

Review of Basic Structural Analysis

Equilibrium and compatibility conditions, Analysis of determinate and indeterminate structures, Energy methods: Virtual work, Castigliano's theorems

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Matrix Methods of Structural Analysis

Flexibility method (Force method), Stiffness method (Displacement method), Formulation of stiffness and flexibility matrices, Application to beams, frames, and trusses

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Analysis of Indeterminate Structures

Moment distribution method, Slope-deflection method, Influence lines for indeterminate structures, Application to continuous beams and frames

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Dynamic Analysis of Structures

Single-degree-of-freedom (SDOF) systems, Multi-degree-of-freedom (MDOF) systems, Free and forced vibrations, Modal analysis and response spectrum analysis, Seismic analysis and design principles

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Nonlinear Structural Analysis

Geometric nonlinearity: Large deflection and buckling analysis, Material nonlinearity: Plasticity

and yielding, Incremental and iterative methods for nonlinear analysis, Applications to steel and concrete structures
Text Books:
1. "Structural Analysis" by R.C. Hibbeler 2. "Matrix Analysis of Structures" by Aslam Kassimali
Reference Books: 1. "Nonlinear Finite Element Analysis of Solids and Structures" by René de Borst et al. 2. "Finite Element Procedures" by Klaus-Jürgen Bathe
NPTEL Links: 1. http://kcl.digimat.in/nptel/courses/video/105106050/L26.html by Prof. Devdas Menon, IIT Madras

ADVANCED STRUCTURAL ANALYSIS LAB					
LAB COURSE CONTENT					
ADVANCED STRUCTURAL ANALYSIS LAB		**Semester:**	**IV**	**Course Code**	**CE-417 B**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

LIST OF ASSIGNMENTS - Any **seven** assignments should be performed.

(i) Deflection of Beams using Moment-curvature Method

(ii) Analysis of Statically Determinate Structures

(iii) Buckling of Columns

(iv) Influence Lines for Beams and Trusses

(v) Analysis of Indeterminate Structures using the Compatibility Method

(vi) Finite Element Analysis (FEA) of Structural Members

(vii) Analysis of Structural Models using Matrix Methods

(viii) Plastic Analysis of Structure
Text Books:
1. "Structural Analysis" by R.C. Hibbeler 2. "Advanced Structural Analysis" by Devdas Menon
Guide lines for ICA:
Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.
Guide lines for ESE:
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Kavayitri Bahinabai Chaudhari
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Bachelor of Engineering – Minor
in
Building Science and Planning
for Second Year Bachelor of Engineering
offered by
Civil
(As per NEP 2020 Guidelines)

Faculty of Science and Technology



SYLLABUS STRUCTURE & COURSE OUTLINE
For Affiliated Colleges
Semester – III & IV
W.E.F. 2025 – 26

Syllabus Structure for Specialization Minor in Building Science and Planning: Additional Credit (Semester – III) (w.e.f. 2025 – 26)

(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-313C	Elements of Architecture	PCC	3			3	40	60			100	3
CE-314C	Elements of Architecture Lab	PCC			2	2			25	25 (OR)	50	1

Syllabus Structure for Specialization Minor in Building Science and Planning: Additional Credit (Semester – IV) (w.e.f. 2025 – 26)

(As per NEP 2020 Guidelines)

Course Code	Name of the Course	Category	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE (CA)	ESE (UA)	ICA (CA)	ESE (UA)		
CE-416C	Topographic Surveying	PCC	3			3	40	60			100	3
CE-417C	Topographic Surveying Lab	PCC			2	2			25	25 (OR)	50	1

ELEMENTS OF ARCHITECTURE (PCC)					
COURSE OUTLINE					
Course Title:	**ELEMENTS OF ARCHITECTURE**	**Short Title:**	**EA**	**Course Code: Theory**	**CE-313C**

Course description:

	Hours/week	No. of weeks	Total hours	Semester credits
Theory	**03**	**15**	**45**	**03**
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Course Objectives:

The Elements of Architecture course provides an in-depth exploration of the fundamental components that constitute architectural design and construction. It introduces students to the core elements such as walls, roofs, doors, windows, columns, stairs, and circulation spaces, emphasizing their functional, aesthetic, and structural roles in the built environment. The course aims to bridge theoretical architectural knowledge with practical skills, allowing students to better understand how these individual elements come together to create cohesive and livable spaces.

The course "Elements of Architecture" is designed to introduce students to the fundamental components and principles of architectural design. The focus is on understanding and analyzing the primary building blocks that form the architecture of spaces, structures, and environments. Through theoretical study and practical application, students will gain insight into the aesthetic, functional, and structural aspects of architectural elements.

1. Introduce students to basic architectural elements and their significance in the creation of buildings and spaces.
2. Develop an understanding of the interrelationship between form, function, and structure in architectural design.
3. Equip students with the knowledge of different materials, structural systems, and architectural styles**.**
4. Encourage students to explore the use of elements like walls, roofs, openings, circulation spaces, etc. in both historical and contemporary contexts.

Course outcomes:

Upon successful completion of this course, students should be able to:

1. Identify and understand the fundamental elements of architecture, such as walls, doors, windows, roofs, and columns, and their significance in architectural design.
2. Analyze the relationship between form and function and how it affects spatial organization in buildings.
3. Understand the role of materials and construction techniques in creating architectural elements.
4. Explain the influence of climate, geography, and culture on the design and evolution of architectural elements.
5. Develop the ability to create and critically evaluate architectural compositions using primary design elements.
6. Apply the knowledge of architectural elements in the design of simple spaces, considering aesthetics, functionality, and structural integrity.

COURSE CONTENT

ELEMENTS OF ARCHITECTURE		**Semester:**	**III**	**Course Code**	**CE-313C**
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End Semester Exam (ESE) UA:**			**60 marks**
		Duration of ESE:			**03 hours**
		Internal Sessional Exam (ISE) CA:			**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Architecture: Definition and scope of architecture, The role of architecture in society, Brief history of architectural evolution

Key Architectural Elements **:**Walls, columns, beams, roofs, openings, floors, and foundations, The importance of understanding scale and proportion

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Types of Walls : Load-bearing vs. non-load-bearing walls, Types of walls: masonry, curtain walls, concrete walls

Wall Construction Techniques , Materials and their implications in design, Thermal, acoustic,

and structural properties of walls

Types of Openings : Windows, doors, skylights, vents, Functions of openings: ventilation, light, aesthetics.

Designing and Sizing Openings :Proportions of windows and doors in a building façade, Impact of openings on natural lighting, ventilation, and energy efficiency

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Roofs and Ceilings: Types of Roofs**,** Flat, sloping, gabled, vaulted, domed, etc. Roof structure and material considerations. Ceiling Design**:** Functionality and aesthetics of ceiling spaces, Materials for ceilings and their thermal/acoustic properties

Circulation Spaces: Types of circulation spaces (stairs, ramps, corridors), Functional and safety considerations, Designing Pathways: Movement, accessibility, and comfort, Hierarchy of spaces and movement patterns in buildings

Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**

Architectural Style and Elements: Classical, Renaissance, Baroque, Modern, Postmodern, etc. The influence of cultural and geographical factors on architectural elements.
Sustainable Design Principles : Eco-friendly materials, energy-efficient systems, and passive design strategies. Environmental factors (sun, wind, temperature) influence on architectural elements

Unit–V:	**No. of Lectures: 09 Hours**	**Marks: 12**

Modern Approaches to Architectural Elements : Integration of technology, new materials, and modern construction methods

Trends in Sustainable and Smart Architecture : Green buildings, intelligent systems, and adaptive reuse of materials

Text Books:

1. "Architecture: Form, Space, and Order" by Francis D.K. Ching
2. "Building Construction Illustrated" by Francis D.K. Ching
3. "The Elements of Modern Architecture" by Andy Pressman
4. "Architectural Design and Drawing" by S. S. Bhatti
5. "Construction and Building Materials" by Barry A. Goodno

Reference Books:

1. "The Architecture Reference & Specification Book" by Julia McMorrough
2. "A Visual Dictionary of Architecture" by Francis D.K. Ching
3. "Introduction to Architecture" by Francis D.K. Ching and Steven P. Juroszek
4. "Fundamentals of Building Construction: Materials and Methods" by Edward Allen and Joseph Iano
5. "Structures: Or Why Things Don't Fall Down" by J.E. Gordon

NPTEL Links:

1. Introduction to Urban Planning by Prof. Dr. Harshit Sosan Lakra, IIT Roorkee
https://archive.nptel.ac.in/courses/124/107/124107158/

2. Modern India Architecture Prof. Dr. P. S. Chani, IIT Roorkee,
https://archive.nptel.ac.in/courses/124/107/124107161/

ELEMENTS OF ARCHITECTURE LAB (PCC)					
LAB COURSE CONTENT					
ELEMENTS OF ARCHITECTURE LAB		**Semester:**	**III**	**Course Code**	**CE-314 C**
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA) CA:**			**25 Marks**
		End Semester Exam (ESE) UA:			**25 Marks (OR)**
End Semester Exam (ESE) Pattern:		**Oral (OR)**			

LIST OF ASSIGNMENTS - Any **five** assignments should be performed.

(i) Study and Representation of Walls

(ii) Study of Openings (Windows and Doors)

(iii) Roof Design

(iv) Circulation Elements (Stairs and Ramps)

(v) Material Study and Testing

(vi) Sustainability in Architectural Elements

Text Books:

1. Architecture: Form, Space, and Order" by Francis D.K. Ching

2. "Building Construction Illustrated" by Francis D.K. Ching

3. "The Elements of Modern Architecture" by Andy Pressman

4. "Architectural Design and Drawing" by S. S. Bhatti

5. "Construction and Building Materials" by Barry A. Goodno

Guide lines for ICA:

Students must perform each practical and submit ICA in the form of journal. Each assignment/design/drawing should be well documented. Faculty in charge will assess the journal/assignments continuously and grade or mark each assignment on completion date declared for each practical/assignment/design.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.

TOPOGRAPHIC SURVEYING (PCC)					
COURSE OUTLINE					
Course Title:	**TOPOGRAPHIC SURVEYING**	**Short Title:**	**TS**	**Course Code:**	**CE - 416 C**

Course description:

This course provides an in-depth understanding of topographic surveying, focusing on the principles, methods, and applications of mapping natural and man-made features on the Earth's surface. Students will learn how to collect, analyse, and represent topographic data using traditional and modern surveying techniques, including levelling, theodolite surveys, total station, GPS/GNSS, and drone-based surveys**.**

The course covers contouring, terrain modelling, and digital elevation mapping, with an emphasis on practical fieldwork and data processing. Applications in engineering, urban planning, environmental management, and disaster risk assessment will also be explored.

By the end of the course, students will be proficient in conducting field surveys, processing survey data, and preparing topographic maps using GIS and CAD tools. Practical sessions and a final project will reinforce hands-on experience.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	03	15	45	03
Practical	**02**	**15**	**30**	**01**

Prerequisite course(s): Nil

Basic Surveying

Course objectives:

1. To familiarize students with topographic surveying methods and equipment.
2. To train students in field data collection and mapping techniques.
3. To develop skills in contouring, profile leveling, and area/volume calculations.
4. To introduce digital methods for topographic data processing.

Course outcomes:

By the end of this course, students will be able to:

1. Understand Basic Surveying Principles – Explain fundamental concepts, principles, and techniques of topographic surveying.

2. Conduct Field Surveys – Apply appropriate field techniques for data collection using modern surveying instruments such as total stations, GPS, and levelling equipment.

3. Generate Topographic Maps – Process survey data and create accurate topographic maps, contour plans, and elevation profiles.

4. Apply Coordinate Systems and Georeferencing – Use coordinate systems, projections, and geore ferencing techniques for precise location mapping.

5. Analyse and Interpret Terrain Data – Interpret and analyse topographic survey data for engineering applications, including slope analysis, drainage patterns, and site development.

COURSE CONTENT			
TOPOGRAPHIC SURVEYING		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3hours/week**	**End Semester Exam (ESE) UA:**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exam (ISE) CA:	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

INTRODUCTION TO TOPOGRAPHIC SURVEYING

Definition and Scope of Topographic Surveying Importance and Applications Types of Topographic Surveys Basic Principles and Standards

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

SURVEYING INSTRUMENTS & EQUIPMENT

Levels (Dumpy Level, Auto Level, Digital Level) Theodolites (Vernier, Digital, and Total Station) Electronic Distance Measurement (EDM) Devices GPS and GNSS for Topographic Surveys Drone and LiDAR-Based Topographic Surveys Maintenance and Calibration of Equipment

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

FIELD DATA COLLECTION Methods of Topographic Data Collection Triangulation and Traverse Surveying Plane Table Surveying Contouring Methods (Direct & Indirect) Leveling (Differential, Profile, and Cross-section) Precautions & Error Minimization in Field Surveys

Methods of Topographic Data Collection Triangulation and Traverse Surveying Plane Table Surveying Contouring Methods (Direct & Indirect) Leveling (Differential, Profile, and Cross-

section) Precautions & Error Minimization in Field Surveys Use of GIS and CAD in Topographic Mapping

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

COMPUTATIONS & DATA PROCESSING

Area and Volume Computation Coordinate Calculations (Latitude, Departure, Bearings)

Error Analysis and Adjustments GIS-based Topographic Data Processing

MODERN TECHNOLOGIES IN TOPOGRAPHIC SURVEYING

UAV/Drone-Based Topographic Surveying LiDAR Technology for Elevation Data Remote Sensing Applications in Topography 3D Terrain Modeling and Analysis

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

APPLICATIONS & CASE STUDIES

Engineering and Infrastructure Development Environmental and Land Management Urban and Rural Planning Disaster Management (Flood, Landslide Hazard Mapping

Guide lines for ICA:
The students must perform the assignments on each unit as prescribed in the syllabus and carryout the assignments given by the teacher. The term work should be assessed on regular bases.

Text Books:

1. Surveying Vol. 1 & 2 – **B.C. Punmia**

2. Surveying and Leveling – **T.P. Kanetkar & S.V. Kulkarni**

Reference Books:

1. Topographic Surveying and Mapping – **Clyde G. Bush**

2. GIS Fundamentals – **Paul Bolstad**

<table>
<tr><th colspan="6">TOPOGRAPHIC SURVEYING LAB (PCC)</th></tr>
<tr><th colspan="6">LAB COURSE CONTENT</th></tr>
<tr><td colspan="2">TOPOGRAPHIC SURVEYING LAB</td><td>Semester:</td><td>IV</td><td>Course Code</td><td>CE-417 C</td></tr>
<tr><td colspan="2">Teaching Scheme:</td><td colspan="4">Examination scheme</td></tr>
<tr><td rowspan="2">Practical:</td><td rowspan="2">2 hours/week</td><td colspan="3">Internal Continuous Assessment (ICA) CA:</td><td>25 Marks</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) UA:</td><td>25 Marks (OR)</td></tr>
<tr><td colspan="3">End Semester Exam (ESE) Pattern:</td><td colspan="3">Oral (OR)</td></tr>
<tr><td colspan="6">LIST OF ASSIGNMENTS - Any five assignments should be performed.

1. Chain and Compass Surveying - Basics of linear and angular measurements Conducting a simple traverse survey Error analysis and corrections

2. Leveling Techniques - Introduction to leveling instruments (Auto level, Dumpy level) Differential leveling and profile leveling Practical application in the field

3. Contouring & Mapping - Contour characteristics and interpolation Contour survey using leveling instruments Plotting contour maps

4. Plane Table Surveying- Setting up a plane table Methods: Radiation Intersection, Traversing Field practice and plotting

5. Theodolite Surveying-Introduction to theodolite and its applications Measurement of horizontal and vertical angles Traversing using theodolite

6. Topographic Mapping & Profile Generation- Techniques for preparing topographic maps Profile and cross-section generation Use of software for data plotting

7. Area & Volume Computation- Calculation of areas and volumes using field data Applications in construction and land development</td></tr>
<tr><td colspan="6">Text Books:</td></tr>
<tr><td colspan="6">Surveying Vol. 1 & 2 – B.C. Punmia

Surveying and Leveling – T.P. Kanetkar & S.V. Kulkarni</td></tr>
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Guide lines for ESE:
ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on oral, paper work and performance in the ESE.