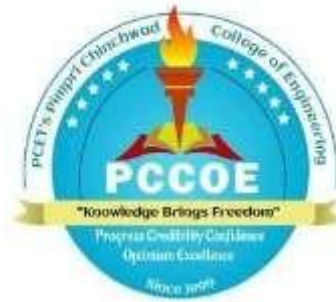


Pimpri Chinchwad Education Trust's
PIMPRI CHINCHWAD COLLEGE OF ENGINEERING
SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044
(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)



**Curriculum Structure and Syllabus
of
Second Year B.Tech Civil Engineering
(Regulations 2023)**



**Effective from Academic Year 2026-27
(Updated with Minor Changes)**

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with ability to think and act independently in demanding situations

EOMS Policy

“We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute’s social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS).”

Course Approval Summary**A) Board of Studies - Department of Civil Engineering**

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Building Planning and Construction	BCI23PC02	15	
2	Building Planning and Construction Lab	BCI23PC03	17	
3	Fluid Mechanics	BCI23PC04	18	
4	Fluid Mechanics Lab	BCI23PC05	20	
5	Strength of Materials	BCI23PC06	21	
6	Techniques and Testing Lab in Civil Engineering	BCI23VS03	47	
7	Total Quality and Human Resource Management in Civil Engineering	BCI23EM01	50	
8	Soil Mechanics	BCI24PC07	56	
9	Soil Mechanics Lab	BCI24PC08	58	
10	Concrete Technology	BCI24PC09	59	
11	Concrete Technology Lab	BCI24PC10	61	
12	Structural Analysis I	BCI24PC11	62	
13	Community Engagement Project	BCI24EL01	77	
14	Operations Research	BCI24EM02	80	

B) Board of Studies - Applied Science and Humanities

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Applied Mathematics (Suggested for Civil Engineering)	BSH23OE03	24	
2	Computational Techniques (Suggested for E&TC branch)	BSH23OE02	26	
3	Applied Mathematics (Suggested for Mechanical branch)	BSH23OE01	28	
4	Neural Network & Fuzzy Logic Control	BSH23OE06	35	
5	Universal Human Values	BSH23VE01	53	
6	Computational Techniques (Suggested for Computer and IT branches)	BSH23OE07 / BSH24OE07	30	
7	Mathematical Optimization (Suggested for CSE -AIML branch)	BSH23OE08 / BSH24OE08	32	
8	Statistical Data Analysis using R	BSH24OE04	65	
9	Advanced Materials & Characterizations	BSH24OE05	66	

10	Professional Development Training	BSH24AE05	78	
11	Constitution of India	BSH24VE02	82	

C) Board of Studies - Department of Computer Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Fundamentals of Database Management System	BCE23OE01	36	
2	Principles of Software Engineering	BCE23OE02	37	
3	Android App Development with Kotlin	BCE23OE03	38	

D) Board of Studies - Department of CSE(AI&ML)

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	AI for Financial Modelling	BCS23OE01	39	
2	Data Science	BCS24OE02	68	

E) Board of Studies - Department of E & TC

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Biology for Engineers	BET23OE03	40	
2	Human Behaviour, Ethics and Wisdom	BET23OE04	41	
3	Electrical Machines	BET24OE01	70	
4	Introduction to Signals and Systems	BET24OE02	71	

F) Board of Studies - Department of Information Technology

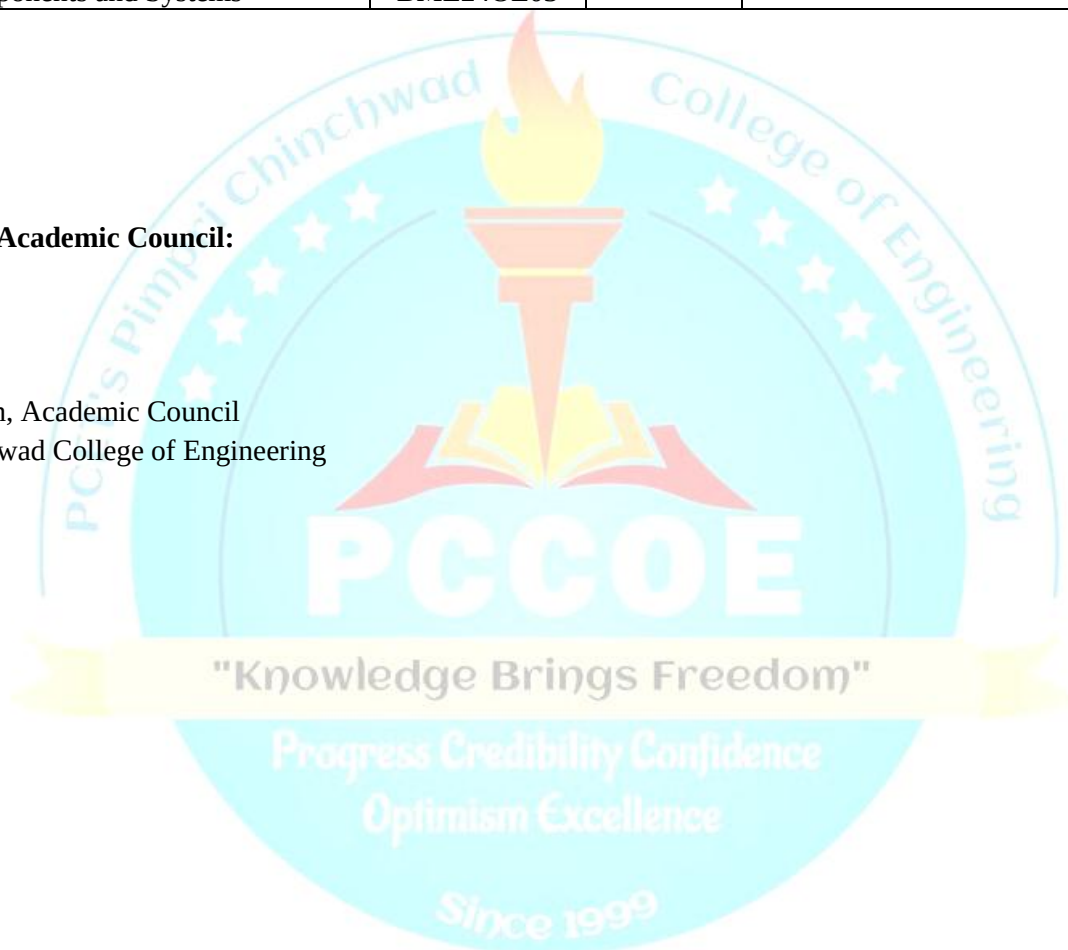
Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Cyber Security : Understanding Cyber Crimes and Legal Perspectives	BIT23OE02	43	
2	Operating System's Administration	BIT24OE01	72	

G) Board of Studies - Department of Mechanical Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Industry 4.0	BME23OE04	44	
2	Energy storage management	BME23OE05	45	
3	Material Science	BME23OE01/ BME24OE01	73	
4	Drawing for Engineers	BME24OE02	74	
5	Fundamentals of Mechanical Components and Systems	BME23OE03/ BME24OE03	75	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering



INDEX

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CURRICULUM FRAMEWORK
(Regulations 2023)
LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Type of Course
1	BSC	Basic Science Course
2	ESC	Engineering Science Course
3	PCC	Programme Core Course
4	PEC	Programme Elective Course
5	MDM	Multidisciplinary Minor
6	OEC	Open Elective Course
7	VSEC	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	EEM	Entrepreneurship/Economics/Management Course
10	IKS	Indian Knowledge System
11	VEC	Value Education Course
12	ELC	Experiential Learning Courses
13	LLC	Liberal Learning Courses

COURSE WISE CREDIT DISTRIBUTION

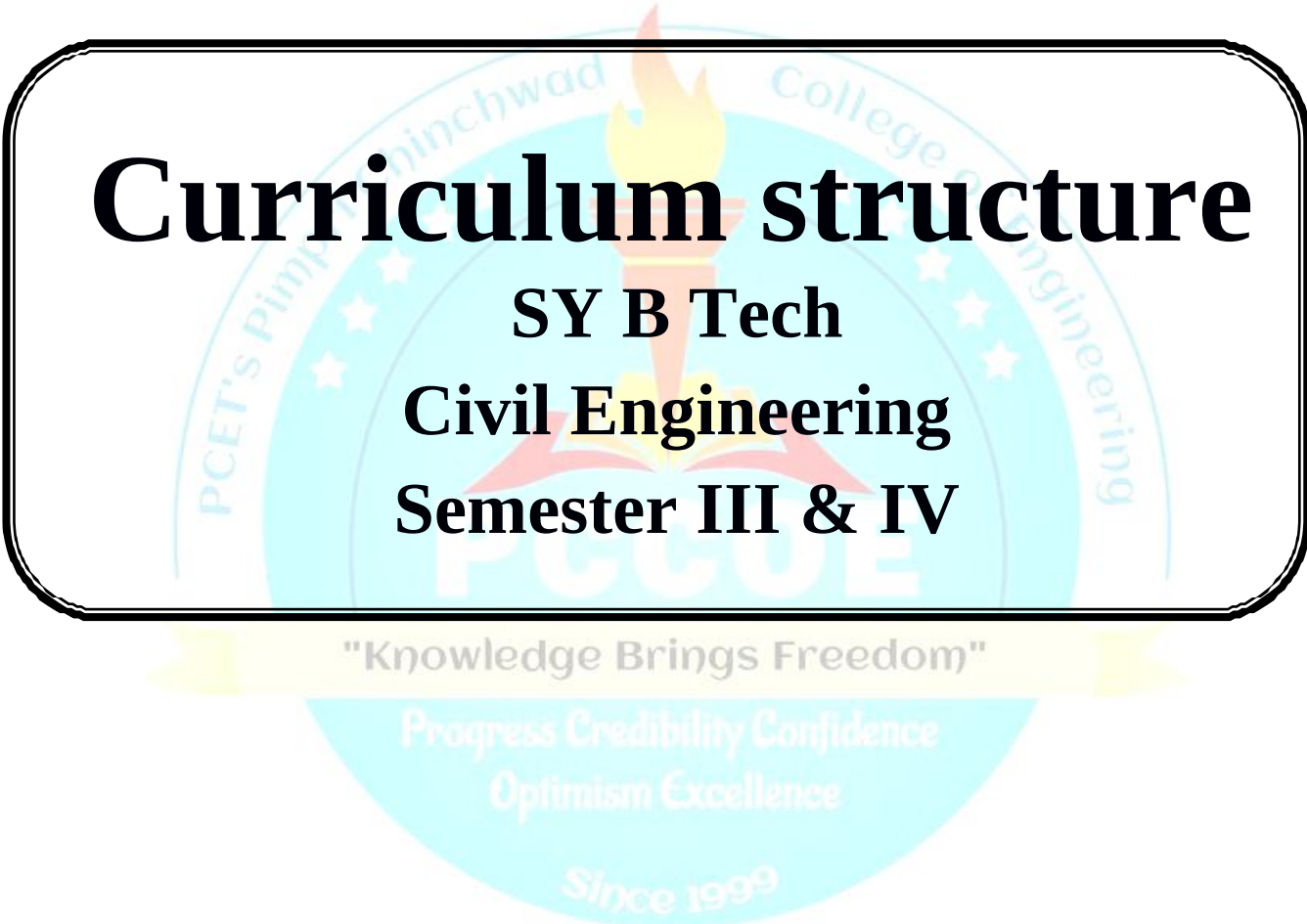
Sr No.	Type of Course	No. of Courses	Total Credits	
			NO.	%
1.	Basic Science Course	8	14	8.75
2.	Engineering Science Course	6	12	7.5
3.	Programme Core Course	26	48	30
4.	Programme Elective Course	11	18	11.25
5.	Multidisciplinary Minor	6	14	8.75
6.	Open Elective Course	3	6	3.75
7.	Vocational and Skill Enhancement Course	4	8	5
8.	Ability Enhancement Course	2	4	2.5
9.	Entrepreneurship/Economics/Management Course	2	4	2.5
10.	Indian Knowledge System	1	2	1.25
11.	Value Education Course	2	4	2.5
12.	Experiential Learning Courses	4	22	13.75
13.	Liberal Learning Courses	2	4	2.5
TOTAL		77	160	100

SEMESTER WISE CREDIT DISTRIBUTION

Sr. No.	TYPE OF COURSE	NO. OF CREDITS/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course	7	5	-	-	-	-	-	-	12
3.	Programme Core Course	-	2	8	8	12	10	8	-	48
4.	Programme Elective Course	-	-	-	-	4	6	6	2	18
5.	Multidisciplinary Minor	-	-	2	2	4	2	4	-	14
6.	Open Elective	-	-	4	2	-	-	-	-	6
7.	Vocational and Skill Enhancement Course	2	2	2	-	-	2	-	-	8
8.	Ability Enhancement Course	-	2	-	2	-	-	-	-	4
9.	Entrepreneurship/Economics/Management Course	-	-	2	2	-	-	-	-	4
10.	Indian Knowledge System	2	-	-	-	-	-	-	-	2
11.	Value Education Course	-	-	2	2	-	-	-	-	4
12.	Experiential Learning Courses	-	-	-	2	-	-	4	16	22
13.	Liberal Learning Courses	2	2	-	-	-	-	-	-	4
TOTAL		20	20	20	20	20	20	22	18	160

SEMESTER WISE COURSE DISTRIBUTION

Sr. No.	TYPE OF COURSE	NO. OF COURSES/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	4	4	-	-	-	-	-	-	8
2.	Engineering Science Course	3	3	-	-	-	-	-	-	6
3.	Programme Core Course	-	1	5	5	6	5	4	-	26
4.	Programme Elective Course	-	-	-	-	2	4	4	1	11
5.	Multidisciplinary Minor	-	-	1	1	2	1	1	-	6
6.	Open Elective	-	-	2	1	-	-	-	-	3
7.	Vocational and Skill Enhancement Course	1	1	1	-	-	1	-	-	4
8.	Ability Enhancement Course	-	1	-	1	-	-	-	-	2
9.	Entrepreneurship/Economics/Management Course	-	-	1	1	-	-	-	-	2
10.	Indian Knowledge System	1	-	-	-	-	-	-	-	1
11.	Value Education Course	-	-	1	1	-	-	-	-	2
12.	Experiential Learning Courses	-	-	-	1	-	-	1	2	4
13.	Liberal Learning Courses	1	1	-	-	-	-	-	-	2
Total		10	11	11	11	10	11	10	3	77



Curriculum structure

SY B Tech

Civil Engineering

Semester III & IV

"Knowledge Brings Freedom"

Progress Credibility Confidence
Optimism Excellence

Since 1999

CURRICULUM STRUCTURE**Second Year B. Tech. (Civil Engineering) (Regulations 2023) Semester-III**
(With effect from Academic Year 2026-27)

Course Code	Course Type	Course Name	Credit Scheme				Teaching Scheme (Hours/ week)				Evaluation Scheme and Marks						
			L	P	T	Total	L	P	T	O	FA		SA	TW	PR	OR	Total
											FA1	FA2					
BCI23PC02	PCC	Building Planning and Construction	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
BCI23PC03	PCC	Building Planning and Construction Lab	-	1	-	1	-	2	-	-	-	-	-	50		25	75
BCI23PC04	PCC	Fluid Mechanics	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
BCI23PC05	PCC	Fluid Mechanics Lab	-	1	-	1	-	2	-	-	-	-	-	50		25	75
BCI23PC06	PCC	Strength of Materials	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
-	#MDM	MDM 1	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
-	OEC	OE-Mathematics	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
-	OEC	OE-DS (Department Specific)	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
BCI23VS03	VSEC 3	Techniques and Testing Lab in Civil Engineering	-	2	-	2	-	4	-	-	-	-	-	75		25	100
BCI23EM01	EEM 1	Total Quality and Human Resource Management in Civil Engineering	2	-	-	2	2	-	-		10	10	30	-	-	-	50
BSH23VE01	VEC 1	Universal Human Values	2	-	-	2	2	-	-		25	25		-	-	-	50
Total			16	4	0	20	16	8	0	3	95	95	210	175	0	75	650

Note: # Refer separate booklet for Multidisciplinary Minor (MDM) courses

L- Lecture, T- Tutorial, P- Practical, CR- Credit, FA – Formative Assessment, SA –Summative Assessment, TW – Term Work, PR- Practical Exam, OR – Oral Exam, O-other i.e. self directed learning, self study, outside the class efforts.

Semester – III**List of Open Elective courses – Mathematics**

Course Code	Offered by	Course Name	
BSH23OE03	AS&H	Applied Mathematics (Suggested for Civil Engineering)	Select any one
BSH23OE02		Computational Techniques (Suggested for E&TC branch)	
BSH23OE01		Applied Mathematics (Suggested for Mechanical branch)	
BSH23OE07 / BSH24OE07		Computational Techniques (Suggested for Computer & IT branch)	
BSH23OE08 / BSH24OE08		Mathematical Optimization (Suggested for CSE-AI&ML branch)	

List of Open Elective courses – Department Specific

Course Code	Offered by	Course Name	
BSH23OE06	AS&H	Neural Network & Fuzzy Logic Control	Select any one
BCE23OE01	Computer	Fundamentals of Database Management System	
BCE23OE02	Computer	Principles of Software Engineering	
BCE23OE03	Computer	Android App Development with Kotlin	
BCS23OE01	CSE(AI&ML)	AI for Financial Modelling	
BET23OE03	E&TC	Biology for Engineers	
BET23OE04	E&TC	Human Behavior, Ethics and Wisdom	
BIT23OE02	IT	Cyber Security : Understanding Cyber Crimes and Legal Perspectives	
BME23OE04	Mechanical	Industry 4.0	
BME23OE05	Mechanical	Energy storage management	

List of courses – Value Educational Course (VEC)

Course Code	Offered by	Course Type	Course Name
BSH23VE01	AS&H	VEC 1	Universal Human Values

CURRICULUM STRUCTURE**Second Year B. Tech. (Civil Engineering) (Regulation 2023) Semester-IV**
(With effect from Academic Year 2026-27)

Course Code	Course Type	Course Name	Credit Scheme				Teaching Scheme (Hours/week)				Evaluation Scheme and Marks						
			L	P	T	Total	L	P	T	O	FA		SA	TW	PR	OR	Total
											FA1	FA2					
BCI24PC07	PCC	Soil Mechanics	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
BCI24PC08	PCC	Soil Mechanics Lab	-	1	-	1	-	2	-	-	-	-	-	50	-	25	75
BCI24PC09	PCC	Concrete Technology	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
BCI24PC10	PCC	Concrete Technology Lab	-	1	-	1	-	2	-	-	-	-	-	50	-	25	75
BCI24PC11	PCC	Structural Analysis I	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
-	#MDM	MDM 2	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
-	OEC	OE-ES (Engineering Sciences)	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
BCI24EL01	CEP	Community Engagement Project	-	2	-	2	-	4	-	-	-	-	-	100	-	-	100
BSh24AE05	*AEC 2	Professional Development Training	-	2	-	2	-	4	-	-	-	-	-	100	-	-	100
BCI24EM02	EEM 2	Operations Research	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
BSh24VE02	VEC 2	Constitution of India	2	-	-	2	2	-	-	-	25	25	-	-	-	-	50
Total			14	6	0	20	14	12	0	3	85	85	180	300	0	50	700

Note: # Refer separate booklet for Multidisciplinary Minor (MDM) courses*** Practical will be held division wise and not batch wise****\$ Refer separate booklet for Exit Policy courses of Civil Engineering Program**

L- Lecture, T- Tutorial, P- Practical, CR- Credit, FA – Formative Assessment, SA –Summative Assessment,
 TW – Term Work, PR- Practical Exam, OR – Oral Exam, O-other i.e. self directed learning, self study, outside the class efforts.

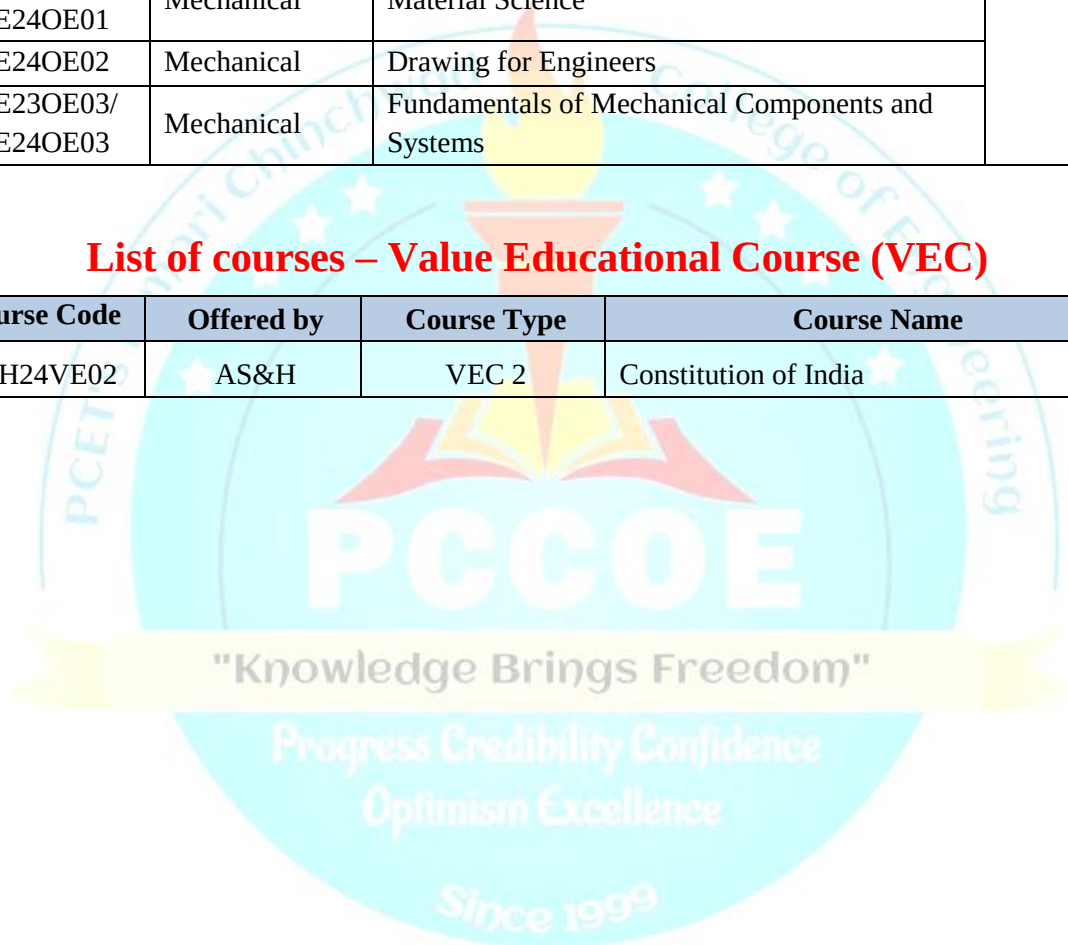
Semester – IV

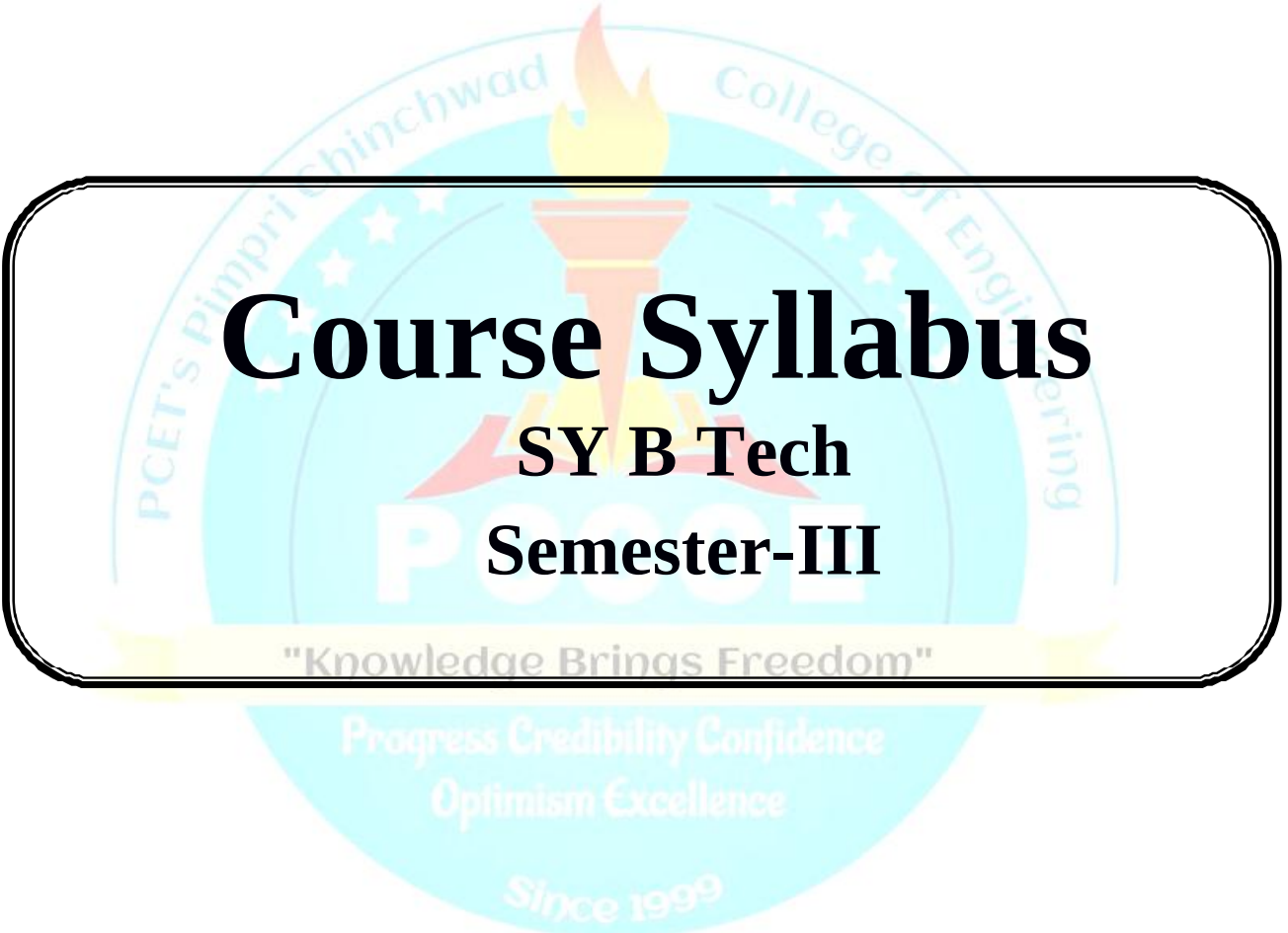
List of Open Elective courses – Engineering Science

Course Code	Offered by	Course Name	
BSH24OE04	AS&H	Statistical Data Analysis using R	Select Any one
BSH24OE05	AS&H	Advanced Materials & Characterizations	
BCS24OE02	CSE(AI&ML)	Data Science	
BET24OE01	E&TC	Electrical Machines	
BET24OE02	E&TC	Introduction to Signals and Systems	
BIT24OE01	IT	Operating System's Administration	
BME23OE01 BME24OE01	Mechanical	Material Science	
BME24OE02	Mechanical	Drawing for Engineers	
BME23OE03/ BME24OE03	Mechanical	Fundamentals of Mechanical Components and Systems	

List of courses – Value Educational Course (VEC)

Course Code	Offered by	Course Type	Course Name
BSH24VE02	AS&H	VEC 2	Constitution of India





Course Syllabus

SY B Tech

Semester-III

"Knowledge Brings Freedom"

Progress Credibility Confidence
Optimism Excellence

Since 1999

Program:	B. Tech. (Civil Engineering)				Semester :		III	
Course:	Building Planning and Construction				Code:		BCI23PC02	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	--	--	1	10	10	30	50
Prior Knowledge:								
1. Knowledge of fundamentals of various aspects of civil engineering like components of building, Bye laws, different materials used in construction is essential.								
Course Objectives: This course aims at enabling students,								
1. To Plan residential and public building according to the norms.								
2. To suggest right construction material and process of building construction.								
Course Outcomes: After learning the course, the students should be able to:								
1. Explain the process of plan and design of building								
2. Explain the material and process of building construction.								
3. Demonstrate understanding of masonry and formwork techniques to plan and supervise building construction								
4. Identify and explain the functions, types, and construction methods of various building components with consideration for reuse of C&D waste.								
Detailed Syllabus								
Unit	Description							Duration (H)
1	Building Planning: Principles of Building & Architectural Planning, Importance of building drawing, Types of building drawings, concept of line plan, presentation drawings, developed plan, sanction plan- elevation, section, selection of scales for various drawings, abbreviations and symbols as per IS 962. Building by-laws- set back distance, open spaces, floor area ratio (F.A.R.), building line, control line, height regulations, standard room sizes, minimum ventilation, and parking space requirement. Introduction to UDCPR.							8
2	Architectural planning of buildings: Functional requirements and dimensions of various units of residential and public buildings. Development of plan, elevation, sectional elevation, and schedule of opening from the given line plan of residential buildings. Prepare water supply, sanitary and electrical layout for residential buildings. Planning of public buildings like primary health center, school building, college canteen, office building. NBC-2016 Guidelines for the planning.							7
3	Masonry construction & Form work: Building components and their basic construction requirements. Foundation- relevance with geotechnical investigation. Masonry- its type, construction procedure and supervision. Scaffolding requirement and types. Recent trends in lightweight masonry, Form work and casting procedure for reinforced concrete columns, R.C.C. beams R.C.C. slabs.							8
4	Building Construction: Various components of building, their functions, types and method of construction of - foundation, plinth, plinth filling, column, beam, slab/roof, flooring, lintel, arches, weather shed, waterproofing treatments, parapet wall, windows, doors, stairs, elevators, escalators etc. Design of dog legged stairs and quarter turn stairs. Process of construction of various building components. Reuse of C&D waste.							7
Total							30	
Self-directed learning- Study of - completed building project, plans and elevations for a various types of building, site visit & review the latest construction trends.								
Text Books:								
1. Building Materials by S.S.Bhavikatti, Vikas Publication House Private Ltd. First Edition (2014)								
2. Building Materials by S.V. Deodhar, Khanna Publication								

3. Building Construction by B.C. Punmia, Laxmi Publications.11th Edition (2016)
4. Building Materials by B.C. Punmia, Laxmi Publications.11th Edition (2016)
5. Building Materials by S. K. Duggal, New Age International Publishers. 5th Edition (2019)
6. Building Construction by S.C. Rangwala, Charotar Publications.33rd Edition (2016).
7. Building Construction by Bindra and Arora, DhanpatRai Publications.11th Edition (2010)
8. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill.5th Edition (2017)

Reference Books:

1. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.5th Edition (1999) ISBN-13
2. Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, Tata McGraw Hill. (1995).
3. National Building Code (R 2016).
4. Building Design and construction by Frederick Merrit, Tata McGraw Hill.5th Edition (1994) Hand Book. 5. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings, Revision-2 (R 2017)

e-Resources

1. <https://www.bis.gov.in/standards/technical-department/national-building-code/>
2. <https://mohua.gov.in/upload/uploadfiles/files/Chap-4.pdf>
3. <https://mohua.gov.in/>



Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Building Planning and Construction Lab			Code:		BCI23PC03	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	--	2	--	50	25	--	75

Prior Knowledge:

Knowledge of fundamentals of various aspects of civil engineering like components of building, Bye laws, different materials used in construction is essential

Course Objectives :

1. To provide knowledge of planning of residential and commercial building.
2. To provide knowledge of material and processes adopted on the field for building construction.

Course Outcomes:

After learning the course, the students should be able to:

1. Plan and Prepare drawings of residential and public buildings.
2. Suggest suitable material and process for building construction.

Detailed Syllabus**Term work consists of a journal containing details of assignments and visit report.**

1. Assignment: Drafting following sketches using CAD a) Types of Foundation b) Entrance Steps- Plan & Elevation c) Types of Arches
2. Draw the line plans of any one residential building and any two public buildings (Using AutoCAD)
3. Floor Plan/ Typical floor plan, elevation and section, area statement with construction notes, schedule of openings, site plan indicating water supply and drainage line of any type of building (with, make group of max. four students) (Using CAD)
4. Introduction to working drawings and selection of scale
5. Visit any commercial building and prepare a report based on the actual guidelines.
6. Report file:
 - a) It shall consist of data used for the project, Planning considerations and line plans & Design calculations.
 - b) The collection of documents is required to sanction the plan.
 - c) Dimension standards of Residential building.
7. Conduct a market survey for different civil engineering materials with respect to application, cost and quality and prepare a report on the same. Also, collect brochures of building materials.
8. Site visit: the student shall visit the construction site and write a detailed report on the processes/ methods adopted for the construction of various building components like footings, staircase, slab, columns, beams, etc.

Reference Books:

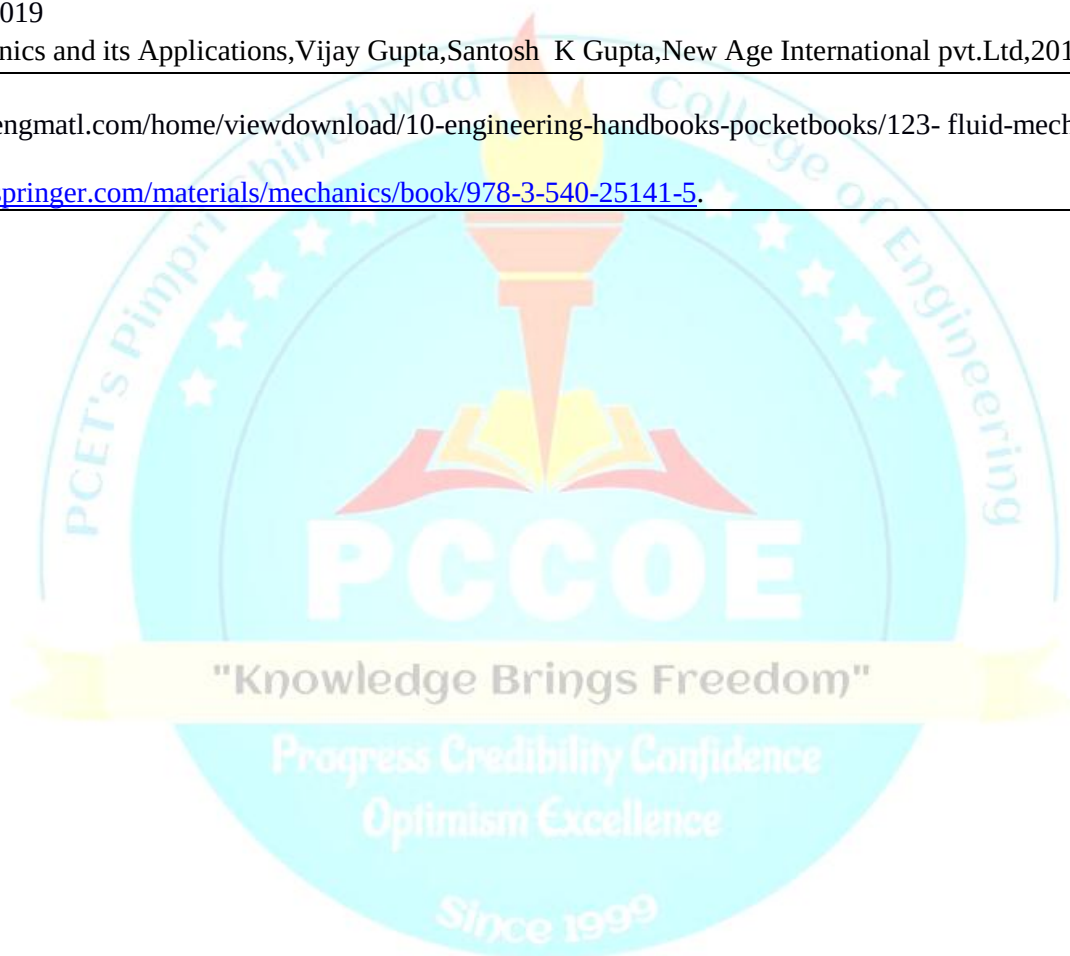
1. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. 5th Edition (5 th July 2017)
2. Auto CAD 2019 Fundamentals Part 1- Autodesk Authorized Publisher.
3. Engineering Graphics Essentials with AutoCAD 2019 Instruction – Kirstie Plantenberg.
4. Beginning Auto CAD 2020 Exercise Workbook – Cherly R. Shrock, Steve Heather.
5. Auto CAD 2018, 3D Modeling – Munir Hamad.

e-Resources

1. <https://www.bis.gov.in/standards/technical-department/national-building-code/>
2. <https://mohua.gov.in/upload/uploadfiles/files/Chap-4.pdf>
3. <https://mohua.gov.in/>

Program:	B. Tech. (Civil Engineering)				Semester :		III
Course:	Fluid Mechanics				Code:		BC123PC04
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks		
	Lecture	Practical	Tutorial	Other	FA		SA
					FA1	FA2	
2	2	-	-	1	10	10	30
Prior Knowledge: 1. Knowledge of physics, engineering mechanics 2. Knowledge of engineering mathematics							
Course Objectives: This course aims at enabling students, 1. To impart knowledge of fluid properties, dimensional analysis using Buckingham II theorem, fluid statics, buoyancy and floatation 2. To build the concept of fluid kinematics and fluid dynamics with reference to modified Bernoulli's equation, laminar and turbulent flow through pipes and flow around submerged bodies 3. To get acquainted with open channel flow							
Course Outcomes: After learning the course, the students should be able to: 1. Calculate fluid properties and carry out dimensional analysis using Buckingham theorem 2. Solve problems involving fluid statics, buoyancy and floatation 3. Explain fluid kinematics, fluid dynamics and flow around submerged bodies 4. Solve problems on open channel flow							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Properties of Fluids: Definition of fluid and fluid mechanics, examples and practical applications involving fluids at rest and in motion, classification of fluids, physical properties of fluids, Newton's law of viscosity. Dimensional Analysis and Model studies: Dimensions of physical quantities, Dimensional homogeneity, dimensional analysis using Buckingham's π theorem method, geometric, kinematic and dynamic similarity, important dimensionless numbers and their significance. Model laws, scale effect, distorted and undistorted models.						07
2	Fluid Statics : Basic equation of hydrostatics, concept of pressure, pressure head, Pascal's law, measurement of pressure, principle of manometers for balancing liquid column, dead weight, pressure measuring devices, pressure transducers and their types, practical applications. Buoyancy and Floatation: Principle of floatation and buoyancy, stability of floating and submerged bodies.						07
3	Fluid kinematics and fluid dynamics: Classification of flows, continuity equation, Euler's equation of motion along a stream line, Bernoulli's equation, applications of Bernoulli's equation, Laminar and turbulent flow through pipe, concept of HGL and TEL, major and minor losses in pipe flow, Water hammer phenomenon, Surge Tank and its functions. Fluid flow around submerged objects: Definitions of drag and lift, types of drag, drag and lift on cylinder and Aerofoil, introduction to Magnus effect, polar diagram, concept of boundary layer theory, methods to control separation.						08
4	Flow through open channel Classification of flow, concept of uniform flow, hydraulically efficient trapezoidal channel cross sections, concept of specific energy, and specific energy curve, hydraulic jump; Location and examples of hydraulic jump, application of momentum equation to hydraulic jump, energy dissipation in hydraulic jump, basics of weirs and notches. Gradually Varied Flow in Open Channels- Definition and types of non-uniform flow; introduction to Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF.						08

Total	30
Self-directed learning -Navier-Stokes Equation, Pump efficiency, cavitation, Net Positive Suction Head (NPSH), Head and discharge suitability, Applications in hydropower systems.	
Text Books: 1. Hydraulics and Fluid Mechanics including Hydraulic Machine by Dr P. N. Modi & S. M. Seth 21 st Edition, Standard book house publication, 2017. 2. Flow in Open Channels by K Subramanya, 5 th Edition, Pub: Tata McGraw Hill, 2019.	
Reference Books: 1. Fluid Mechanics by R. J. Garde and A.J. Mirajgaonkar Pub : SCITECH Publications(India)Pvt.Ltd, Chennai,2010 2. Fluid Mechanics by Streeter Wylie and Bedford – Pub : McGraw Hill International ,New Delhi,2017 3. Open Channel Hydraulics by Ven Tee Chow, Pub : McGraw Hill Book Company , Koga,2009 4. A Text Book of Fluid Mechanics and Hydraulic Machines, by Dr. R.K.Rajput, Pub S Chand and Co.Ltd,2015 5. Fluid Mechanics, Fundamentals and applications by Yunus A. Cengel and John M.Cimbala, Mc Graw Hill International ,2019 6. Fluid Mechanics and its Applications, Vijay Gupta, Santosh K Gupta, New Age International pvt.Ltd,2012	
Hand books: 1. http://www.engmatl.com/home/viewdownload/10-engineering-handbooks-pocketbooks/123-fluid-mechanics-handbook 2. http://www.springer.com/materials/mechanics/book/978-3-540-25141-5 .	



Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Fluid Mechanics Lab			Code:		BCI23PC05	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	02	-	50	25	-	75

Prior Knowledge:

1. Knowledge of fundamentals of physics is essential

Course Objectives :

1. To impart knowledge of properties of fluid, pressure measurement and buoyancy
2. To provide Knowledge of fluid kinematics, fluid dynamics and fluid flow around submerged bodies
3. To impart knowledge of open channel flow.

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate viscosity, pressure, discharge measurement and seepage below weir.
2. Apply basic principle of stability of floating bodies, Bernoulli's theorem, Darcy-Weisbach friction factor
3. Analyze flow around circular cylinder or Aerofoil, velocity distribution and uniform flow in open channel

Detailed Syllabus**A) List of Laboratory Experiments:** (Any *eight* out of the following)

1. Measurement of viscosity of fluid by Redwood viscometer
2. Measurement of pressure using different pressure measuring devices (including Transducers /state of arts digital instruments also).
3. Determination of stability of floating bodies using ship model
4. Experimental verification of Bernoulli's theorem with reference to loss of energy
5. Calibration of venturimeter / orifice meter.
6. Determination of minor loss in a pipe system /Darcy- Weisbach friction factor (f) for a given pipe and study of variation with Reynolds number (Re)
7. Flow around a circular cylinder/Aerofoil
- 8 Study of uniform flow formulae for open channel
9. Velocity distribution in open Channel Flow.
10. Drawing flow net by Electrical Analogy for flow below Weir (with and without sheet pile)

B) Assignments: (Any *two* out of the following)

1. Applications of WaterGEMS/EPANET in pipe flow analysis
2. Study of Specific Energy Diagram and plotting it for given problem statement
3. Developing a demo model related to any fluid flow phenomenon (physical model/soft model)

C) Site visit: Report on Site visit to hydropower plant or any one of the Research Institute (CWPRS, WALMI, NWA etc.)

Reference Books:

1. Fluid Mechanics by R.J.Garde and A. J. Mirajgaonkar Pub : SCITECH Publications(India)Pvt.Ltd, Chennai,2010
2. Fluid Mechanics by Streeter Wylie and Bedford – Pub : McGraw Hill International ,New Delhi,2017
3. Open Channel Hydraulics by Ven Tee Chow, Pub : McGraw Hill Book Company , Koga,2009
4. A Text Book of Fluid Mechanics and Hydraulic Machines, by Dr. R.K.Rajput, Pub S Chand and Co.Ltd,2015
5. Fluid Mechanics, Fundamentals and applications by Yunus A. Cengel and John M.Cimbala, Mc Graw Hill International , 2019
6. Fluid Mechanics and its Applications, Vijay Gupta, Santosh K Gupta, New Age International pvt.Ltd,2012

Hand books:

1. <http://www.engmatl.com/home/viewdownload/10-engineering-handbooks-pocketbooks/123- fluid-mechanics-handbook>
2. <http://www.springer.com/materials/mechanics/book/978-3-540-25141-5>

Program:	B. Tech. (Civil Engineering)				Semester :		III	
Course:	Strength of Materials				Code:		BC123PC06	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	-	-	1	10	10	30	50
Prior Knowledge: 1. Engineering Mathematics, Engineering Mechanics. (Derivative, integration, mathematical calculations, equilibrium conditions, types of supports and analysis of beams is essential)								
Course Objectives: This course aims at enabling students, 1. To impart knowledge of stresses and strains for determinate structural members. 2. To build concept of shear force and bending moment diagram for determinate beams. 3. To provide knowledge of slope and deflection for determinate structural members.								
Course Outcomes: After learning the course, the students should be able to: 1. Calculate different types of stresses, strains in determinate and indeterminate structures. 2. Develop shear force and bending moment diagram for determinate beams and calculate the torsional stresses in circular shaft. 3. Calculate shear & bending stresses and Principle Stresses & Strains. 4. Determine the slopes and deflection of determinate beams.								
Detailed Syllabus								
Unit	Description							Duration (H)
1	Simple stresses and strains: a) Stress and strain -linear, lateral, shear and volumetric, generalized Hooke's law. Elastic constants and their relationship for isotropic materials. b) Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self-weight and temperature changes.							8
2	Shear force, bending moment diagram and torsion of circular shafts: a) Concept and definition of shear force and bending moment. Beams under various types of loading, shear force and loading diagram from given bending moment diagram. b) Stresses, strains and deformation in determinate and indeterminate shafts of hollow and solidsections of homogenous and composite materials subjected to torsion.							8
3	Stresses in beams due to shear & bending and Principal Stresses & Strains. a) Shear stress distribution diagram for standard sections, maximum and average shear stress. Theory of pure bending, flexure formula, bending stress distribution diagram, moment ofresistance and section modulus b) Introduction to principal stresses and strains (member subjected to a Uniaxial Force System)							7
4	Slope and deflection of determinate beams: a) Double integration method (Macauley's method). b) Moment Area method, Conjugate beam method.							7
Total								30
Self –directed learning- Practice of solving the Numericals on simple stresses, SFD and BMD of determinate beams, Calculation of Principal stresses, and slope deflection by Conjugate Method.								
Text Books: 1. Mechanics of Structures Vol. I by S. B. Junnarkar and Dr. H. J. Shah, Charotar Publishing House Pvt Ltd., 23 rd Edition, 2013.								

2. Strength of Materials by R. Subramanian, Oxford University Press, 4th Edition, 2012 Strength of Materials by S. S. Ratan, Tata McGraw Hill. 2nd Edition, 2011

Reference Books:

1. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd. 5th Edition, 2013.
2. Strength of Materials by F.L. Singer and Andrew Pytel, Harper and Row Publication.
3. Mechanics of Materials by Beer and Johnston, McGraw Hill Publication. 7th Edition, 2017
4. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication. 2nd Edition, 2011
5. Mechanics of Materials by Gere & Timoshenko, CBC publisher. 8th Edition, 2013
6. Elementary Structural Analysis by Norris, Wilbur and Utku, Tata McGraw Hill Publisher.
Intermediate Structural Analysis by R. C. Hibbler, Pearson Education Publishers.

e-Resources

1. <https://nptel.ac.in/courses/105/105/105105108/>
2. <https://nptel.ac.in/courses/112/107/112107146/>



Open Elective- Mathematics

**SY B Tech
Semester-III**

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Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Applied Mathematics (OE-Mathematics Suggested for Civil branch from AS&H)			Code:		BSH23OE03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior knowledge: 1. Univariate Calculus 2. Multivariate Calculus is essential							
Course Objectives: After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to: 1. Statistical techniques, Probability theory, and Hypothesis techniques. 2. Higher level mathematics and their applications in Civil Engineering.							
Course Outcomes: After learning the course, the students should be able to: 1. Apply descriptive statistical techniques to numerical data. 2. Draw inferences from data using probability theory and hypothesis testing. 3. Find approximate solutions for interpolation, integration and ordinary differential equations. 4. Examine the vector fields using concepts of vector differentiation and Integration.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Statistics: Measures of Variability, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.						7
2	Probability Distributions: Probability, Theorems on Probability, Mathematical Expectation, Binomial, Poisson and Normal Distribution. Hypothesis Test: z-test, t-test, Chi-Square test, ANOVA Test.						8
3	Numerical Methods: Interpolation: Finite Differences, Newton’s and Lagrange’s interpolation formula Numerical Integration: Trapezoidal and Simpson’s rule. Ordinary differential equations: Euler’s, Modified Euler’s and Runge-Kutta fourth order methods.						7
4	Vector Differentiation: Introduction, Vector differential operators, Gradient, Divergent, Curl, Directional Derivatives, Solenoidal and Irrotational fields, Scalar Potential. Vector Integration and Applications: Introduction to Line, Surface and Volume Integration of Vectors, Work-done, Green’s Lemma, Gauss’s Divergence theorem, Stoke’s theorem.						8
Total							30
Text Books: 1. Peter V. Neil, “Advanced Engineering Mathematics”, Thomson Learning ,7 Edition, ISBN 13:9781337274524. 2. B.V. Ramana , “Higher Engineering Mathematics”, Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.							

Reference Books:

1. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13: 9780486492797
2. S.R.K. Iyengar, Rajendra K. Jain, “Advanced Engineering Mathematics”, Alpha Science International, Ltd,4 Edition, ISBN 13: 9781842658468
3. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13: .9788174091955
4. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320

e-sources: NPTEL Course lectures links:

1. <https://nptel.ac.in/courses/111/105/111105090/> (Probability)
2. https://onlinecourses.nptel.ac.in/noc20_ma13/ (Advanced Engineering Mathematics)
3. V-lab (IIT-Bombay) link: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php



Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Computational Techniques (OE-Mathematics Suggested for E&Tc branch)			Code:		BSH23OE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior knowledge: 1. Univariate Calculus 2. Multivariate Calculus is essential							
Course Objectives: After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to: 1. Statistical techniques, Probability theory, and hypothesis techniques. 2. Numerical techniques to approximate solutions for interpolation, integration and ordinary differential equations.							
Course Outcomes: After learning the course, the students should be able to: 1. Apply descriptive statistical techniques to numerical data. 2. Analyze random phenomena using probability theory and distributions. 3. Draw inferences from data using hypothesis testing. 4. Find approximate solutions for interpolation, integration and ordinary differential equations.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Statistics: Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.						7
2	Probability Distributions: Probability, Theorems on Probability, Random Variable, Probability mass function, Mathematical Expectation, Probability distributions: Binomial, Poisson, and Normal.						8
3	Sampling Distribution: Introduction and Types, Population vs Sample Hypothesis Tests: Level of significance, Confidence interval, p-Test, z-test, t-test, Chi-Square test, ANOVA Test.						7
4	Numerical Methods: Interpolation: Finite Differences, Newton’s and Lagrange’s interpolation formula. Numerical Integration: Trapezoidal and Simpson’s rule Ordinary differential equations: Euler’s, Modified Euler’s and Runge-Kutta fourth order methods						8
Total							30
Text Books: 1. Peter O’Neil, “Advanced Engineering Mathematics”, Thomson Learning ,7 Edition, ISBN 13:9781337274524. 2. B.V. Ramana , “Higher Engineering Mathematics”, Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.							

Reference Books:

1. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13:9780486492797.
2. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13:9788174091955.
3. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320
4. H.K. Das, “Advanced Engineering Mathematics”, S Chand & Company Ltd, 22 edition, ISBN 9352533836.

e-sources: NPTEL Course lectures links:

1. [Probability Theory for Data Science - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/112106001) (Statistics, Probability and Hypothesis testing)
2. [Numerical methods - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/112106002) (Numerical Methods)



Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Applied Mathematics (OE-Mathematics Suggested for Mech branch)			Code:		BSH23OE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior knowledge: 1. Univariate Calculus 2. Multivariate Calculus is essential							
Course Objectives: After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to: 1. Statistical techniques and Probability theory for Data Analysis. 2. Partial differential equations applied to mechanical engineering problems such as mechanical vibrations and heat transfer. 3. Laplace Transform and Inverse Laplace Transform applied to solve linear differential equations.							
Course Outcomes: After learning the course, the students should be able to: 1. Apply descriptive statistical techniques to numerical data. 2. Draw inferences from data using probability theory and hypothesis testing. 3. Solve wave, heat and Laplace equations using separation method. 4. Find Laplace and Inverse Laplace Transform for piecewise continuous function and solution of linear differential equations.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Statistics: Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.						7
2	Probability Distributions: Probability, Theorems on Probability, Mathematical Expectation, Binomial, Poisson, and Normal Distributions. Hypothesis Test: z-test, t-test, Chi-Square test, ANOVA Test.						8
3	Applications of Partial Differential Equations: Solution to One dimensional Wave, Heat and Transport equation, Two-dimensional heat flow equation using Method of separation of variables.						7
4	Laplace Transform: Introduction, Laplace Transform of some standard and special functions, Region of convergence and Properties, properties and theorems of Laplace Transformation. Inverse Laplace Transform, Application of Laplace Transform to solve LDE.						8
Total							30
Text Books: 1. Peter O’Neil, “Advanced Engineering Mathematics”, Thomson Learning ,7 Edition, ISBN 13:9781337274524. 2. B.V. Ramana , “Higher Engineering Mathematics”, Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.							

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics" Wiley Eastern Ltd., 10 Edition, ISBN 13: 9780470458365
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, 42 Edition, ISBN 13: 9788174091955.
3. N. P. Bali, Manish Goyal, "A textbook of Engineering Mathematics", 9th Edition, ISBN 16: 978-8131808320
4. H.K. Das, "Advanced Engineering Mathematics", S Chand & Company Ltd, 22 edition, ISBN 9352533836..

e-sources: NPTEL Course lectures links:

1. <https://nptel.ac.in/courses/111/105/111105038/> (P.D.E)
2. https://onlinecourses.nptel.ac.in/noc20_ma13/ (Advanced Engineering Mathematics)



Program:	B. Tech. (Civil Engineering)			Semester :		III/IV	
Course:	Computational Techniques (OE Maths Suggested for Comp/Comp R/IT branch)			Code:		BSH23OE07/ BSH24OE07	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior knowledge: 1. Univariate Calculus 2. Multivariate Calculus is essential							
Course Objectives: After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to: 1. Statistical techniques, Probability theory, and hypothesis techniques. 2. Different mathematical approaches for optimization.							
Course Outcomes: After learning the course, the students should be able to: 1. Apply descriptive statistical techniques to numerical data. 2. Analyze random phenomena using probability theory and distributions. 3. Draw inferences from data using hypothesis testing. 4. Apply optimization techniques in transportation and assignment problems.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Statistics: Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting (line, parabola & exponential curves), Correlation and Linear Regression						7
2	Probability Distributions: Probability, Theorems on Probability, Random Variable, Probability mass function, Mathematical Expectation, Probability distributions: Binomial, Poisson, and Normal						8
3	Sampling Distribution: Introduction and Types, Population vs Sample Hypothesis Tests: Level of significance, Confidence interval, p-Test, z-test, t-test, Chi-Square test, ANOVA Test.						7
4	Transportation Problems: Introduction, Mathematical model of transportation problem, Methods of finding initial solutions: North-west Corner rule, least cost method, VOGEL's approximation method, Optimality of initial solution using MODI Method. Assignment Problems: Introduction, Mathematical model of Assignment problem, solutions to Assignment problems using Hungarian method.						8
Total						30	
Text Books: 1. Peter O'Neil, "Advanced Engineering Mathematics", Thomson Learning ,7 Edition, ISBN 13:9781337274524. 2. B.V. Ramana , "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.							

Reference Books:

1. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13:9780486492797.
2. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13:9788174091955.
3. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320
4. H.K. Das, “Advanced Engineering Mathematics”, S Chand & Company Ltd, 22 edition, ISBN 9352533836.

e-sources:

NPTEL Course lectures links:

1. [Probability Theory for Data Science - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/110/106/110106059/) (Statistics, Probability and Hypothesis testing)
2. <https://nptel.ac.in/courses/110/106/110106059/>(Transportation&AssignmentsProblems)



Program:	B. Tech. (Civil Engineering)			Semester :		III/IV	
Course:	Mathematical Optimization (OE Maths Suggested for CSE-AI&ML)			Code:		BSH23OE08/ BSH24OE08	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior knowledge: 1. Univariate Calculus 2. Multivariate Calculus is essential							
Course Objectives: After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to: 1. Different mathematical approaches for optimization. 2. Commonly used tools and techniques in network analysis.							
Course Outcomes: After learning the course, the students should be able to: 1. Solve Linear Programming Problems using graphical and simplex methods. 2. Apply optimization techniques in transportation and assignment problems. 3. Analyze project networks using Critical Path Method and Project Evaluation & Review Techniques. 4. Apply numerical methods for optimal solutions of constrained, unconstrained linear and nonlinear programming problems.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Linear Programming (LP): Introduction, formulation of Linear Programming problems, Graphical solution method, multiple optimal solutions, Unbounded solutions, Infeasible solutions, Simplex Method.						8
2	Transportation Problems: Introduction, Mathematical model of transportation problem, methods of finding initial solutions: North-west Corner rule, Least cost method, VOGEL's approximation method, Optimality of initial solution using MODI Method. Assignment Problems: Introduction, Mathematical model of Assignment problem, solutions to Assignment problems using Hungarian method.						7
3	Network Analysis: Network Diagram, Project Management: PERT and CPM, Critical path analysis, Project scheduling with uncertain activity time, and Project time-cost						8
4	Unconstrained optimization: One-dimensional search methods, Gradient-based methods, Conjugate direction and quasi-Newton methods, Constrained Optimization: Lagrange theorem						7
						Total	30
Text Books: 1. Rao S. S., Engineering Optimization Theory and Practice, Willy Eastern Ltd.4th Edition, ISBN: 978-0-470- 18352-6 2. Taha Hamdy, Operation Research: An Introduction, Pearson Education,9th Edition, ISBN:0134444019							

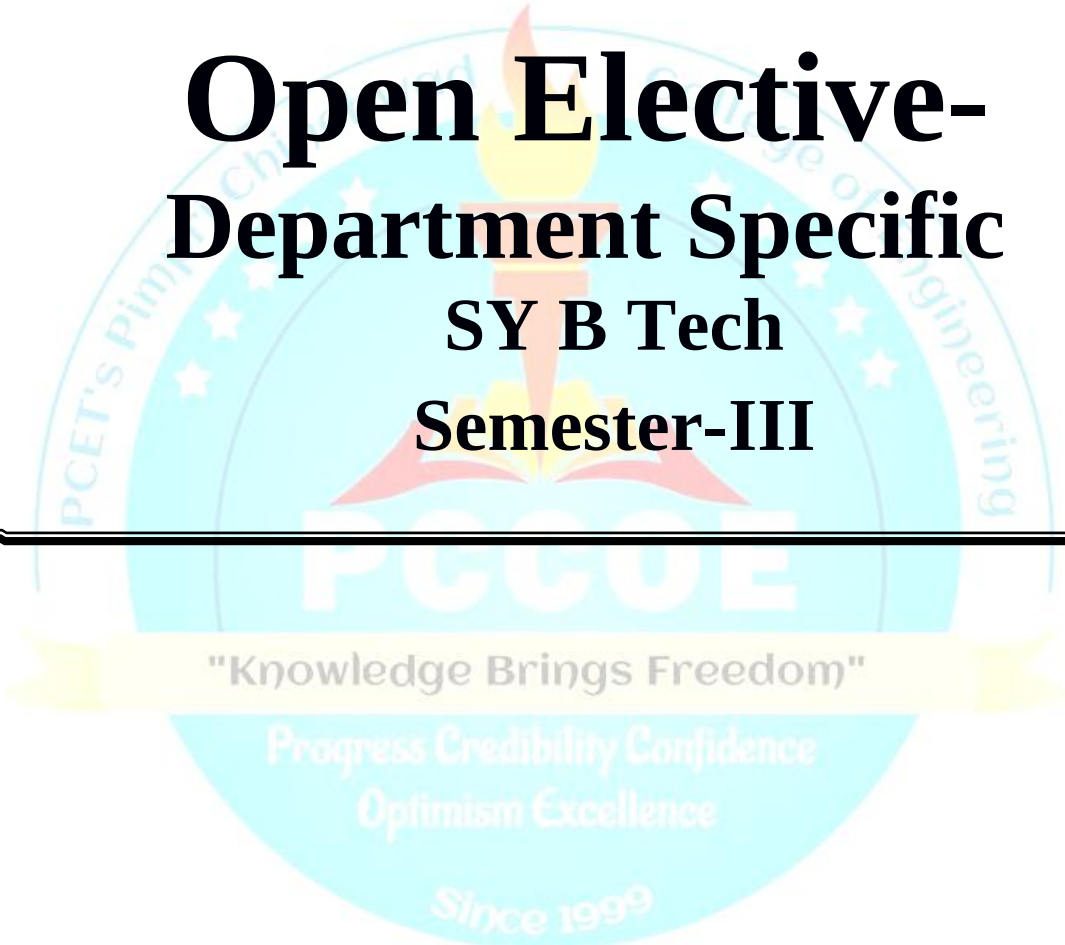
Reference Books:

1. Sharma S.D. Operation Research, Kedarnath Ramnath & Co. Edition, ISBN: 9380803389
2. Peter. O'Neil, "Advanced Engineering Mathematics," Thomson Learning, 7 Edition, ISBN 13: 9781337274524
3. Hira Gupta, "Operation Research," S.Chand Publication, ISBN(13): 9788121909686.
4. Sharma J.K. "Operations Research-Theory and Applications," Trinity Press, 6 Edition, ISBN: 9789385935145

e-sources: NPTEL Course lectures links:

1. <https://nptel.ac.in/courses/111/102/111102012/> (LPP)
2. <https://nptel.ac.in/courses/110/106/110106059/> (Transportation & Assignments Problems)



The logo of PCCOE (Pune College of Civil Engineering) is a circular emblem. It features a central torch with a flame, set against a background of a blue sky with white stars. The text "PCCOE" is prominently displayed in the center. Below the torch, there is a banner with the motto "Knowledge Brings Freedom". At the bottom of the emblem, the words "Progress Credibility Confidence" and "Optimism Excellence" are written, followed by "Since 1999".

Open Elective- Department Specific SY B Tech Semester-III

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Neural Network and Fuzzy Logic Control (OE-Department Specific offered by AS&H)			Code:		BSH23OE06	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior Knowledge: Nil							
Course Objectives: 1. To provide knowledge of Neural Networks and apply them for modelling and controlling real-time dynamic systems. 2. To apply fuzzy logic techniques for solving various engineering and decision-making problems.							
Course Outcomes: After learning the course, the students will be able to: 1. Describe learning rules, activation functions and basics of neural networks. 2. Implement backpropagation and optimizer algorithms for weight updates of Neural Network. 3. Apply fuzzy set concepts for fuzzification and defuzzification. 4. Perform Mamdani and Sugeno fuzzy inference system in real world problems.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Architecture of Neural Network: Introduction; biological neural networks; artificial neural networks; architecture of artificial neural networks—bias, activation functions, learning methods, and learning rules; types of neural networks such as single-layer, multi-layer, feedforward, and recurrent neural networks.						7
2	Neural Networks for Control: Loss functions; weight initialization; optimization algorithms; backpropagation algorithm; associative memory networks and their types; discrete-time Hopfield networks.						8
3	Fundamentals of Fuzzy Logic: Classical sets; fuzzy sets; membership functions; cardinality of fuzzy sets; fuzzy complement; fuzzy composition; properties and operations on fuzzy sets; fuzzy relations; fuzzification; and defuzzification.						7
4	Fuzzy Logic Control: Fuzzy rules; decision-making logic; linguistic variables; fuzzy inference systems including Mamdani FIS and Sugeno FIS; design of fuzzy controllers; fuzzy optimization; and applications of FIS to real-life problems.						8
Total						30	
Text Books: 1. Kosko, B, “Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence”, Prentice Hall, NewDelhi, 2004. 2. Ross T. J., “Fuzzy logic with engineering applications (Vol. 2)”, New York: Wiley, 2004, ISBN: 9783030375478							
Reference Books: 1. Jack M. Zurada, “Introduction to Artificial Neural Systems,” PWS Publishing Co., Boston, 2002. 2. Zimmerman H.J., “Fuzzy set theory and its Applications,” Kluwer Academic Publishers Dordrecht, 2001. 3. Driankov, Hellendroonb, “Introduction to fuzzy control,” Narosa Publishers,2001. 4. G Klir, B Yuan, “Fuzzy sets and fuzzy logic: Theory and application,” PHI, ISBN: 5. LauranceFausett, Englewood Cliffs, N.J., “Fundamentals of Neural Networks,” PearsonEducation, New Delhi, 2008. 6. B Yegnanarayana: Artificial Neural Networks for pattern recognition, PHI Learning Pvt. Ltd., 14-Jan-2009							
e-sources: 1. Online course “Fuzzy Logic and Neural Network” by Prof. Dilip Kumar Pratihari, IIT Kharagpur. https://nptel.ac.in/courses/127/105/127105006/							

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Fundamentals of Database Management System (OE-Department Specific offered by Computer)			Code:		BCE23OE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50

Prior Knowledge: Basic Mathematics

Course Objectives:

1. To make students understand the fundamental concepts of database management.
2. To provide a foundation in database concepts.
3. To make students familiar with building database design.
4. To make students understand SQL queries and concepts.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the fundamental concepts of database management systems.
2. Design E-R Model for given requirements and convert the same into database tables.
3. Design schema in appropriate normal form considering requirements.
4. Use SQL to write queries for given requirements.

Detailed Syllabus

Unit	Description	Duration (H)
1	Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database System Structure.	6
2	Data Models, Database Design, Entity Relationship Model, ER Diagram, Extended ER diagram, converting E-R and Extended ER diagram into tables.	8
3	Relational Model: Basic concepts, CODD's Rules, Relational Integrity: Domain, Referential Integrity Database Design: Features of Good Relational Designs, Normalization, Atomic Domains, and First Normal Form, 2NF, 3NF, BCNF.	8
4	SQL Language commands DDL, DML, DCL SQL: Characteristics and advantages, SQL Data Types, SQL Operators, Tables: Creating, Modifying, Deleting, Updating, DML Queries: SELECT Query and clauses, SQL - Ordering of Tuples, Aggregate Functions, SQL Functions, Sub queries	8
Total		30

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020, ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.

Reference Books:

1. Coronel, C. and S. Morris, —Database Systems: Design, Implementation, & Management, 12th edition, Cengage, 2016.
2. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674

e-sources:

1. <http://w3schools.org/>

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Principles of Software Engineering (OE-Department Specific offered by Computer)			Code:		BCE23OE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50

Prior Knowledge: problem-solving skills is essential.

Course Objectives:

1. To introduce the fundamental phases of the Software Development Life-cycle (SDLC).
2. To make students understand the methods for capturing, specifying, and analyzing software requirements.
3. To make students understand the concept of UML Diagrams for software project development.
4. To provide the fundamental understanding of the agile process model.

Course Outcomes:

After learning the course, the students will be able to:

1. Compare and Select appropriate Software Development Life-cycle (SDLC) Process Model.
2. Comprehend methods for capturing, specifying, and analyzing software requirements.
3. Design UML Diagrams for software project development.
4. Comprehend the basics of agile process model for the development of software projects.

Detailed Syllabus

Unit	Description	Duration (H)
1	Introduction to Software Engineering Definition of Software, Software Application Domains, Software engineering layers, Software engineering practice, The Essence of Practice, General Principles, Software Development Life Cycle (SDLC) Models: Waterfall Model, V Model, Incremental Process Model, Evolutionary Process Models, Unified Process, Phases of the Unified Process. Case Study: Safe Home	8
2	Requirements Analysis Requirement Engineering, Requirements engineering tasks, Establishing the Groundwork-Eliciting Requirements, Collaborative Requirements Gathering, Quality Function Deployment, Usage Scenarios, Elicitation Work Products, Developing use cases, Software requirements document. Case Study: Safe Home	7
3	Software Design & Modeling Concepts Design Concepts, Design Process and Design Quality, Design Models, Modeling Concepts and Diagrams, Introduction to UML, Use Case Diagrams, Class Diagrams, Activity Diagrams, Deployment Diagrams.	8
4	Agile development Process Agile Process- Extreme Programming in agile development, Agile software development process Models, SCRUM – process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting.	7
Total		30

Text Books:

1. Roger S Pressman, "Software Engineering – A Practitioner's Approach", Pearson Education, 9th Edition, ISBN 9789355325044, 2023.
2. Ian Sommerville, "Software Engineering", 10th edition, ISBN-13: 9780137503148, 2021.
3. Unified Modeling Language User Guide, The (2nd Edition) (Addison-Wesley Object Technology Series), ISBN:978-0-321-26797-9, May 2005.

Reference Books:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", Prentice Hall India, ISBN 10: 0133056996, 2002.
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN 13: 978-8120348981, 2014.
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715, 2010.

e-sources:

1. <http://w3schools.org/>

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Android App Development with Kotlin (OE-Department Specific offered by Computer)			Code:		BCE23OE03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50

Prior Knowledge: Basic Programming is essential.

Course Objectives:

1. To explore Kotlin programming language features.
2. To familiarize with the concepts of Kotlin.
3. To get acquainted with Android features, networks, and data handling techniques.
4. To develop an Android app with testing.

Course Outcomes:

After learning the course, the students will be able to:

1. Explore object-oriented programming with Kotlin.
2. Illustrate the concept of Kotlin fundamentals
3. Apply the network handling and Android UI techniques.
4. Deploy the Android application with testing.

Detailed Syllabus

Unit	Description	Duration (H)
1	Introduction to Kotlin programming language Introduction to Kotlin programming language, Setting up Android Studio development environment, Basics of Kotlin syntax and basic programming concepts, Variables, data types, and operators in Kotlin.	6
2	Kotlin fundamentals Conditional statements, Loops, Functions, parameters, Kotlin collections, Classes and objects, Properties, fields, and methods, Inheritance, polymorphism, and interfaces, Data classes and sealed classes.	9
3	Android architecture, Android UI and Networking Android Architecture, Activities and life cycle, Views, View groups, fragments and lifecycle, Working with RESTful APIs and JSON data, Using Retrofit and OkHttp for network communication, Implementing LiveData and ViewModel, Asynchronous programming.	9
4	Android App Development and Testing Case study: Picture gallery, Developing an App, Unit testing and UI testing with Junit and Espresso, Preparing and publishing app to Google Play store	6
Total		30

Text Books:

1. Laurence PO, Hinchman-Dominguez A, G. Blake Meike, Dunn M. "Programming Android with Kotlin", O'Reilly Media, Inc.; 2021. ISBN:9781492063001
2. Lim G. "Beginning Android Development With Kotlin" Greg Lim; 2020. ISBN:9811477973, 9789811477973

Reference Books:

1. Trivedi Hardik. "Android application development with Kotlin", BPB Publications; 2020.
2. Fazio M. "Kotlin and Android Development featuring Jetpack", Pragmatic Bookshelf; 2021.

e-sources: <https://developer.android.com/>

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	AI for Financial Modelling (OE-Department Specific offered by CSE(AI&ML))			Code:		BCS23OE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior Knowledge: Nil							
Course Objectives: 1. To understand the essentials of financial modeling 2. To learn to build a simple financial model. 3. To perform the analyses of financial models and Apply AI/ML methods for forecasting. 4. To use AI enabled platforms for finance tasks							
Course Outcomes: After learning the course, the students will be able to : 1. Learn the essentials of financial modeling 2. Understand core AI and machine learning concepts and algorithms relevant to finance. 3. Apply AI/ML methods for financial forecasting. 4. Use AI enabled tools and platforms for finance tasks							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to Financial Modelling : Importance and Applications in Finance, Key Financial Statements (Income Statement, Balance Sheet, Cash Flow), Basic Excel Techniques for Financial Modelling, Overview of Financial Ratios and KPIs, Limitations of Traditional Modelling Techniques.						7
2	Basics of Artificial Intelligence and Machine Learning: Introduction to AI and Machine Learning, Types of Machine Learning (Supervised, Unsupervised), Common Algorithms in Finance: Linear Regression, Decision Trees, Clustering, Introduction to Python for AI (basics, IDEs, libraries: NumPy, Pandas), Data Preprocessing for Financial Datasets.						8
3	AI Applications in Financial Modelling: AI for Forecasting Revenue and Expenses, AI for Credit Risk Assessment across financial applications, AI in Fraud Detection, Portfolio Optimization Basics, Predictive Analytics in Budgeting and Planning.						8
4	Tools, Ethics, and Future Trends : AI Tools for Finance: Power BI/Tableau, AutoML Platforms, Introduction to FinTech and Robo-Advisors, Ethical Considerations: Data Privacy, Bias, Model Interpretability. Case Studies of AI in Financial Services						7
Total							30
Text Books: 1.Yves Hilpisch, “Artificial Intelligence in Finance: A Python-Based Guide”, O’Reilly Media Inc., July 2019, ISBN: 9781492055433 2.Jannes Klaas, “Machine Learning for Finance”, Packt Publishing, 2019, ISBN: 9781789136364							
Reference Books: 1.Edward P.K.Tsang, “AI for Finance”, Routledge Taylor and Francis, 1st Edition, 2023, ISBN 9781032384436							
e-sources: 1. https://www.udemy.com/course/python-and-machine-learning-in-financial-analysis/ 2. https://www.udemy.com/course/ai-for-finance/							

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Biology for Engineers (OE- Department Specific offered by E&TC)			Code:		BET23OE03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50
Prior Knowledge: Basics of Human Anatomy and physiology Basics of Electronics Engineering							
Course Objectives: This course aims at enabling students, 1. To introduce biological engineering principles, procedures needed to solve real-world problems. 2. To provide an overview of human anatomy and physiology in order to support biomedical engineering solutions. 3. To introduce biomedical sensors, signal processing and diagnostic systems. 4. To provide a basic knowledge of the applications of biological systems in relevant industries.							
Course Outcomes: After learning the course, the students should be able to: 1. To understand basics of human physiological system and its cell functioning 2. To understand human immune system and significance of microbiology 3. To map role of biology in designing industrial applications 4. To understand biomedical sensors, its interfacing and related to measurement systems.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	CELL PHYSIOLOGY : Introduction to the cell biology – Cell size and shape - Chemical composition - Classification of cell and its properties, Cell cycle; Cell signaling, Transport across cell membrane; Introduction to Human physiology – Circulatory system - Respiratory system - Excretory system - Nervous system.						08
2	IMMUNOLOGICAL SCIENCE: Immune system and its types; Functional properties of antibodies; Helper T cells and T cell activation; Importance of Microbiology.						07
3	BIOLOGY AND ITS INDUSTRIAL APPLICATION: Introduction : Bioreactors, biocontrol, biofilters, biopolymers, bioenergy, biomaterials, biochips, Nano-Biomolecules and its various types: Principles and Application of Biosensor; Basics of Biochips – Bio fertilizer – Bioinformatics – Bio fuel.						07
4	INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: Need and Challenges in measurement of the parameters in living systems, Source of bioelectric potential: Resting and action potential, propagation of action potential, depolarization and re-polarization. Introduction to few important bio-potential such as Electrocardiogram(ECG), Electroencephalogram(EEG) and Electromyogram (EMG).						08
Total						30	
Text Books: 1. Dr. Sohini Singh and Dr. Tanu Allen, “Biology for Engineers”, Vayu Education Of India, New Delhi, 2014. 2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, 2 nd edition, Prentice Hall of India							
Reference Books: 1. Arthur T. Johnson, “Biology for Engineers” CRC Press, 2011. 2. Goldsby RA, Kindt TK, Osborne BA and Kuby J (2003) Immunology, 5th Edition, W.H. Freeman and Company, New York. 3. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008 4. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012 5. John G. Webster(Editor), Amit J. Nimunkar (Editor), Medical Instrumentation: Application and Design, 5 th edition Wiley publication 6. Joseph H. Carr, John M. Brown, Introduction to Biomedical equipment Technology, 4 th edition , Pearson publication							

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Human Behavior, Ethics & Wisdom (OE- Department Specific offered by E&TC)			Code:		BET23OE04	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50
Prior Knowledge: Nil							
Course Objectives: This course aims at enabling students, 1. To develop a clear understanding of success in terms of academic, career, and life dimensions, and help students identify the ultimate human goal. 2. To enable students to build harmonious relationships and responsible behavior based on right understanding, values, and priorities. 3. To cultivate ethical conduct and holistic thinking for sustainable living, professional competence, and universal harmony.							
Course Outcomes: After learning the course, the students should be able to: 1. Differentiate the career success, academic success and life success 2. Identify the correct priority order in life and illustrate the human goal 3. Understand that the relationships are definite 4. Understand the Interconnectedness between all the orders in existence							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Understanding success and Living domain of Human Academic success (marks), career success (recognition & position), life success (balance & contentment), ultimate goal of human being, Difference between happiness and excitement Continuous happiness vs temporary pleasure, Right Understanding (RU), Relationship (R), Physical Facility (PF) with right priority, how our choices are affected by RU, R, PF. Understand the human being On the basis of needs and activities						07
2	Human Behavior Behavior driven by: Desire or Fear or Understanding Relationship as the foundation of life, Understanding the expectations in 7 relationships Mother-Father/Son-Daughter, Husband-Wife, Brother-Sister, Friend-Friend, Teacher-Student, Colleague-Coworker, Societal Nine core human values in relationships (trust, respect, affection, care, etc.), Justice and fairness Marriage as: A foundation for family stability, Purpose of Marriage, Common Problems in Marriage Justice in Family, Ability to build Stable, respectful relationships, Parenting & Values						08
3	Wisdom & Universal Harmony (Holistic Living) Sustainable living, Human role in society Human Goal (Resolution, Prosperity, Fearlessness, Coexistence) Five dimensions to fulfill human goal - Education- Sanskar (Inculcation), Justice-Protection, Production-Work, Exchange-Storage, Health-Self regulation Universal order and interconnectedness - The four orders in nature - Interconnectedness and mutual fulfillment						08

4	Ethics & Human Conduct Natural acceptance, Responsibility and duty, Fair roles and responsibilities, Gender equality in dignity Definite Human Conduct -Behavior Work, Participation in relationships Right wealth, Right marital relationship, Right work and behavior Values, Policies, Character Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies,	07
Total		30
Text Books: : 1. A. Nagaraj, Jeevan Vidya: Ek Parichaya. Amarkantak, India: Jeevan Vidya Prakashan, 1999. 2. A. Nagaraj, Manava Vyavahāra Darsana. Amarkantak, India: Jeevan Vidya Prakashan, 2003. 3. R. R. Gaur, R. Asthana, and G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd rev. ed. New Delhi, India: Excel Books, 2019. ISBN: 978-93-87034-47-1.		
Reference Books: 1. A. Nagaraj, Vyavahārvādī Samājshāstra. Amarkantak, India: Jeevan Vidya Prakashan, 1999. 2. A. Nagaraj, Vyavharatmak Janvad. Amarkantak, India: Jeevan Vidya Prakashan, 2009. 3. A. Nagaraj, Abhyas Darshan. Amarkantak, India: Jeevan Vidya Prakashan, 2004. 4. M. K. Gandhi, Hind Swaraj or Indian Home Rule. Ahmedabad, India: Navajivan Publishing House, 1909. 5. S. R. Covey, The Seven Habits of Highly Effective People. New York, NY, USA: Free Press, 1989. 6. Aristotle, The Nicomachean Ethics. Translated by W. D. Ross. Oxford, U.K.: Oxford University Press, 1925.		
e learning: 1. http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/ 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw 3. https://youtu.be/OgdNx0X923I 4. https://www.edx.org/learn/happiness/university-of-california-berkeley-the-science-of-happiness 5. https://www.youtube.com/watch?v=11E0ZaoGqEI		

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Cyber Security: Understanding Cyber Crimes and Legal Perspectives (OE-Department Specific offered by IT)			Code:		BIT23OE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50

Prior Knowledge: of Fundamentals of the Internet is essential

Course Objectives:

1. To learn the concepts of cyber security for understanding and addressing digital threats effectively.
2. To learn about legal frameworks governing information technology and cyber law.

Course Outcomes:

After learning the course, the students will be able to:

1. Explain the principles and necessity of cyber security
2. Categorize various cyber threats, cybercrimes, and cyber legal frameworks.
3. Apply cyber forensic techniques to identify criminal activities.
4. Use preventative measures to stop social engineering scams.

Detailed Syllabus

Unit	Description	Duration (H)
1	Introduction to Cyber Security Cyber Security – History of Internet– Impact of Internet; Reason for Cyber Crime – Need for Cyber Security; History of Cyber Crime, Cyber Security Concepts: Introduction to cyber security, Types of cyber security, Information Assurance Fundamentals, Attacker Techniques and Motivations, Cyber security Challenges, Incident response process, Security policy, Risk Analysis and Management, CIA Triad	8
2	Cyber Crime and Law Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes, Planning cyber-attacks by cybercriminals, Careers in Cyber Security. Cyber Laws—The Indian IT Act—Cyber Crime and Punishment. Types of Threats, Types of Hacker, Hacking and Cracking, Hacking: Ethical issues, Ethical Hacking.	8
3	Cyber Forensics Introduction to Cyber Forensics: Cyber forensics investigation process, digital evidence, challenges in cyber forensics; Types of forensics, Anti- forensics practices, Anti-forensics detection techniques. Email Forensics: e-mail Protocols, email crimes, email forensics;	7
4	Social Engineering Introduction of social engineering and cyber security, Evolution of Social Engineering, Social Engineering Ethics, Purpose , Prevention methods, Insider attacks, defining social engineering-categories, Phases, attack spiral model, Attack Vendors-social approach, socio-technical approach. Identity Theft, Preventing Insider Threats,	7
Total		30

Text Books:

1. Nina Godbole and Sunil Belapure. Cyber Security: Understanding Cyber Crimes, Computer Forensics, and Legal Perspectives, Wiley INDIA. ISBN 978-81-265-2179-1.
2. Niranjan Reddy, Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations. Apress, ISBN-13: 978-1-4842-4459-3
3. William Stallings, “Cryptography and Network Security: Principles and Practice”. Pearson Publication.

Reference Books:

1. William Stallings, Computer Security: Principles and Practices, Pearson, 6th Ed., ISBN: 978- 0- 13- 335469-0
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81- 315-1349- 1
3. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN 978- 81- 203-5082-3

e-sources:

1. <https://www.udemy.com/course/certified-secure-netizen/>
2. <https://www.coursera.org/professional-certificates/google-cybersecurity>

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Industry 4.0 (OE-Department Specific offered by Mech)			Code:		BME23OE04	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior Knowledge: Basic programming skills, Mathematical skills							
Course Objectives: This course aims at enabling students, 1. To introduce revolutions of manufacturing industry 2. To introduce technological advancement in modern manufacturing industries 3. To Introduce concepts of smart manufacturing, emphasizing Industry 4.0 in manufacturing industries							
Course Outcomes: After learning the course, the students will be able to: 1. Correlate the recent manufacturing trends and technological pillars of Industry 4.0. 2. Apply pillars of Industry 4.0 to the manufacturing industry. 3. Adapt the changes in existing manufacturing practices and relate the role of industrial robotics and sensors.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Industrial revolution and current state of industry: Overview of industrial revolution, Introduction to Automation, hard automation, soft automation, classification of production system, adaptive control, overview of terminologies like CAD, CAM, CAE, CAPP etc.						6
2	Introduction to Industry 4.0: Introduction to industry 4.0, need for Industry 4.0, Framework for Industry 4.0, technological pillars in industrial 4.0, applications, challenges and scope for industry 4.0						8
3	Technological developments in Industry 4.0: Introduction to Smart Manufacturing, overview of big data and analytic techniques, cyber security, Internet of things (IoT), Industrial Internet of things (IIoT), Cloud computing, artificial intelligence.						8
4	Robotics and Sensors: Introduction to technological components of Robot, classification of sensors and its applications in Manufacturing industry, Role of robots in Industry 4.0, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics						8
						Total	30
Text Books: 1. Nine pillars of technologies for Industry 4.0, W. Leong, IET publishers, 2020 2. Industry 4.0, A. Gilchrist, Apress Publication, 2016 3. Industrial Automation: Hands On, Lamb, Frank. , McGraw-Hill Professional, 2013							
Reference Books: 1. C. Schröder, The Challenges of Industry 4.0 for Small and Medium-sized Enterprises, 2021. 2. Chua C. K., Leong K. F., Lim C. S., Rapid Prototyping, World Scientific, 2012. 3. A.Nayyar and A. Kumar, A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development-Springer International Publishing, 2020. https://doi.org/10.1007/978-3-030-14544-6 4. K. Kumar, D. Zindani, J. P. Davim, Industry 4.0: Developments towards the Fourth Industrial Revolution, Springer Singapore, 2019.							
e-sources: 1. https://nptel.ac.in/courses/108105063							

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Energy Storage Management (OE-Department Specific offered by Mech)			Code:		BME23OE05	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50

Prior Knowledge: Fundamentals of Engineering and basic sciences

Course Objectives:

This course aims at enabling students,

1. To explore energy storage systems' fundamentals, technologies, and applications.
2. To enable students to understand the principles of energy storage systems design.
3. To provide a general awareness of energy storage audit, safety, and management.

Course Outcomes:

After learning the course, the students will be able to:

1. Differentiate and select energy storage systems based on performance and safety.
2. Select material and analyze the energy storage in thermochemical form.
3. Analyze energy storage system with batteries/supercapacitors/fuel cells.
4. Perform audit of Energy storage systems

Detailed Syllabus

Unit	Description	Duration (H)
1	Energy storage system: Introduction, Need, Modes, Energy storage devices, Merits, and Demerits of different types of Storage, utilization, and system applications. Performance: Energy capture rate and efficiency, Discharge rate and efficiency, Dispatch ability and load flowing characteristics, Scale flexibility, durability, Cycle lifetime, mass.	8
2	Thermochemical storage – Types, Phase Change Materials (PCMs) and classifications, properties of the PCMs for different temperature ranges, Selection criteria of PCMs for heating and cooling in buildings, Application of PCM in energy storage. SHS mediums, Energy analysis of the latent heat storage based on different systems	7
3	Energy Storage for transportation: Mechanical Design and Packaging of Battery, Packs for Electric Vehicles, Advanced Battery-Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Li-ion Batteries, Thermal run-away for battery systems, State of Charge and Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles Fuel cell: Operational principle, types, hybrid fuel cell-battery systems, hybrid fuel cell-supercapacitor systems,	8
4	Energy Storage Management Relationship between economic growth and energy use, Energy demand analysis in different economic sectors, increase energy conversion efficiencies by introducing energy storage, Energy audit of energy storage system, The carbon markets, Safety: Risks of fire, explosion, toxicity, Ease of materials, recycling, and recovery, Environmental consideration, and recycling	7
Total		30

Text Books:

1. A.R. Pendse, "Energy Storage Science and Technology," SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN – 13:9789380090122), 2011.
2. JiuJun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, "Electrochemical Technologies for Energy Storage and Conversion," John Wiley and Sons, 2012.
3. Lithium-Ion Batteries Basics and Applications by Reiner Korthauer, Springer.
4. Fuel cells from fundamentals to applications by Supramaniam Srinivasan, Springer.

Reference Books:

1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt, "Energy Storage in Power Systems" Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016.
3. Pistoia, Gianfranco, and Boryann Liaw. The behavior of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018.
4. E. Lipman, A. Z. Weber, Fuel Cells and Hydrogen Production, A Volume in the Encyclopedia of Sustainability Science and Technology, Second Edition, Springer reference.
5. Handbook of Energy Audit by Sonal Desai Publisher Tata McGraw Hill.



Program:	B. Tech. (Civil Engineering)			Semester :	III	
Course:	Techniques and Testing Lab in Civil Engineering			Code:	BCI23VS03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks		
	Lecture	Practical	Tutorial	TW	Oral	Total
02	--	04	--	75	25	100

Prior Knowledge: NIL

Course Objectives: This course aims at enabling students,

1. To provide the knowledge of characteristics and behavior of civil engineering materials used in buildings and Infrastructure.

Course Outcomes: After learning the course, the students should be able to:

1. Determine the characteristics/properties of construction materials and interpret the results.
2. Analysis of results in comparison with the standards.
3. Application of results for appropriate decision.

Detailed Syllabus

A. Testing of Materials:

1. Tension test on mild and TMT steel.
2. Bend and Rebend test on TMT.
3. Shear (Single & Double) test on mild steel.
4. Torsion test on mild steel.
5. Impact (Izod & Charpy) test on mild steel, aluminum, brass.
6. Compression test on timber (Parallel & Perpendicular)
7. Bending test on timber and plywood.
8. Abrasion test of flooring tiles.
9. Demonstration of Rapid Chloride Permeability Test (RCPT) on concrete. (ASTM C1202)
10. Analysis of determinate beams by using software tools.

B. Geotechnical Engineering: (Any Two)

1. Study of soil classification systems (AASHTO, Textural, IS, Unified, GI).
2. Determination of specific gravity of soil using density bottle method.
3. Determination of field density of soil using water displacement method.

C. Transportation Engineering: (Any Three)

1. Aggregate impact value test
2. Aggregate crushing strength test
3. Specific gravity and water absorption test by basket method
4. Shape test (Flakiness and elongation index)

D. Fluid Mechanics: (Any Three)

1. Study of Hydraulic jump as Energy Dissipater
2. Impact of Jet
3. Basic Characteristics of Pelton Wheel Turbine and Centrifugal Pump
4. Calibration of Notch

E. Environmental Engineering Field Laboratory: (Any Three)

1. Water quality analysis – Water Testing kit
2. Determination of presence of bacteria in water and residual chlorine
3. Measurement of sound level
4. Measurement of ambient air quality

F. Advanced 3-D Printing Laboratory:

1. Fused Deposition Method (FDM) 3 D Printing- Draftig /.STL/ Slicing/ Printing
2. Concrete Element 3 D Printing from .dwg file at large scale

G. Site Visit:

1. Site visit exploring practical field knowledge related to the fundamental areas of Civil Engineering.

Reference Books:

1. S. Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill, 4th Edition, 2013.
2. W. A. Nash Strength of Material, Schaum's Outline Series, McGraw Hill, 4th edition, 1998.
3. S. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd., 3rd edition, 1997.
4. J. M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co. 6th edition, 2008.
5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 3rd edition, 2002.
6. Partha Chakroborty and Animesh Das, Principles of Transportation Engineering, Prentice Hall Publications, 2nd edition, 2027
7. Standard Methods for examination of water and wastewater, Mary Franson, American Public Health Association.
8. Water Supply and Sanitary Engineering, G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi,
9. 9th Edition, (2010).
10. Air pollution and Control KVSG Murali Krishna, University Science Press, 2015
11. Air Pollution, H. V. N. Rao and M. N. Rao, TMH, Pub., 2004
12. Fluid Mechanics by R.J.Garde and A.J. Mirajgaonkar Pub : SCITECH Publications (India) Pvt.Ltd, Chennai,2010
13. Fluid Mechanics by Streeter Wylie and Bedford – Pub : McGraw Hill International , New Delhi,2017
14. Open Channel Hydraulics by Ven Tee Chow, Pub : McGraw Hill Book Company , Koga,2009
15. Flow in Open Channels by K Subramanya, 5 th Edition, Pub: Tata McGraw Hill, 2019
16. Geotechnical Engineering by C. Venkatramaiah, New Age International Publishers, 5 th Edition, 2017.
17. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition, 2020.
18. Geotechnical Engineering by P Purushothma Raj, Tata McGraw Hill, 2017.
19. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition, 2017.
20. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition, 2016.
21. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International Students Edition.

IS Codes:

1. I.S. 1608:1995 Method for tensile testing of steel products.
2. 5242:1979 Methods of test for determining shear strength of metals
3. 1717 Method of simple torsion test.
4. 1598 For Izod impact test
5. 1727 For Charpy impact test.
6. 1708 (part 8) – 1986 Compression test on timber (Parallel to grain)
7. 1708 (part 9)- 1986 Compression test on timber (Perpendicular to grain)
8. 1708 and 883 Bending strength and modulus of elasticity of timber
9. 3495 (part III)- 1976 Water absorption capacity of bricks, Efflorescence test on bricks
10. 3495 (part-I) Compressive strength of bricks
11. IS 10500:2012 Drinking water specifications.
12. IS 3025: 2013, Methods of Sampling and Test (Physical, Chemical and Biological) for Water and Waste Water,
13. Bureau of Indian Standards, New Delhi.
14. I.S. 5182 (all parts)
15. SP36 Compendium of Indian Standards on Soil Engineering, Part 1:1987 Laboratory Testing of soils for Civil Engineering Purposes.
16. ASTM C1202 for Rapid Chloride Penetration Test.

**Entrepreneurship/ Economics/
Management Course
(EEM)**

**SY B Tech
Semester-III**

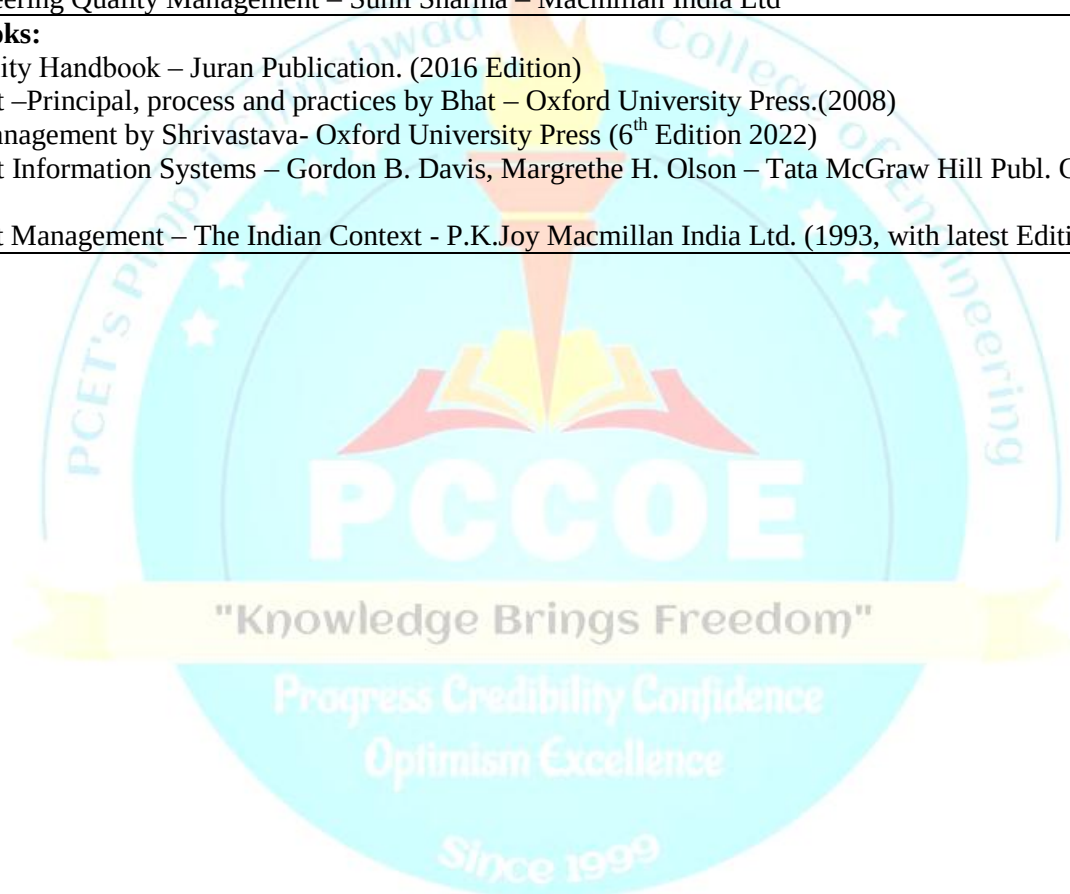
"Knowledge Brings Freedom"

Progress Credibility Confidence
Optimism Excellence

Since 1999

Program:	B. Tech. (Civil Engineering)			Semester :		III	
Course:	Total Quality and Human Resource Management in Civil Engineering			Code:		BCI23EM01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior Knowledge: Elements of Civil Engineering, Awareness of Quality and related Aspects							
Course Objectives: After Completing this course, student will be able to: 1. Interpret quality aspects of various quality gurus. 2. Use various tools for Quality improvement to identify defects in construction and suggest remedial measures. 3. Apply ISO principles and prepare quality documentation for various processes. 4. Optimize resources in the challenging environment of the construction industry.							
Course Outcomes: After learning the course, the students should be able to: 1. Apply quality management principles in construction by understanding quality concepts, distinguishing quality systems, analyzing causes of poor quality, and managing construction defects effectively. 2. Implement TQM and ISO 9001 principles through documentation, audits, checklists, and cost of quality concepts to ensure effective quality management in construction projects. 3. Apply TQM tools, Six Sigma, supply chain practices, and continuous improvement techniques, and understand quality certification systems to enhance construction project performance. 4. Understand modern HRM concepts, roles, and systems, and apply HRM practices to manage people effectively in a changing project environment.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Concept of Quality a) Quality – Various definitions and interpretation by various Quality gurus. Importance of Quality in construction lifecycle- Quality during Design stage, Procurement, Execution, Maintenance, b) Difference between, quality control, quality assurance, Total Quality Control and Total Quality Management (TQM), c) Factors affecting quality of construction, reasons for poor quality & measures to overcome, d) Defects in construction & it’s classification. Measures to prevent and rectify defects.						8
2	TQM, ISO & Quality Manual a) Study of ISO 9001: Introduction, principles, and uses, Quality manual – Importance, contents, Documents not equal to Quality. Audits: types and significance. ISO-9001 clauses mapped to site execution, contractor activities and role of consultant, difference between ISO 9001 and project quality, b) Importance of check-lists in achieving quality. Typical checklist for concreting activity, form work activity, steel reinforcement activity, introduction to ITP, hold points and witness points, c) Cost of Quality, types, significance in Quality, Cost of conformance and Non-Conformance. Quality vs Productivity vs Cost- Myth: “Quality increases cost” Concept of Right First Time (RFT)						7
3	TQM tools, Cost of Quality& Certification a) TQM – Necessity, advantages, Six sigma as a tool in TQM., Numericals on Six Sigma, DMAIC-DMADV cycle, construction specific examples, b) Supply chain management as a tool in TQM, Benchmarking in TQM, Kaizen in TQM, 5-S concept, Zero Defect, Basic quality tools- Pareto chart, cause and effect, control charts, flow chart, c) Introduction to: CONQAS, CIDC-CQRA certification.						8

4	HRM in Changing Environment & Trends in HRM - Meaning, Definition, Features, Scope, Objectives, Importance, Principles of HRM, Evolution of HRM, Functions of HRM, Challenges of HRM, Site labour management, contractor- subcontractor coordination, challenges-Skill gaps and skill development and safety culture. - Role of HR Manager, Difference between HRM & Personnel Management, Competencies needed in project managers, Leadership styles and desired behavior - Human Resource Information System (HRIS), Conflict management , official co ordination techniques, Indian construction quality, Informal labor, Site supervision issues	7
Total		30
Text Books: - Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra - Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ.Company - Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra - Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd		
Reference Books: - Juran's Quality Handbook – Juran Publication. (2016 Edition) - Management –Principal, process and practices by Bhat – Oxford University Press.(2008) - Financial management by Shrivastava- Oxford University Press (6th Edition 2022) - Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co. (2022) - Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd. (1993, with latest Edition)		



Value Education Course (VEC)

SY B Tech Semester-III

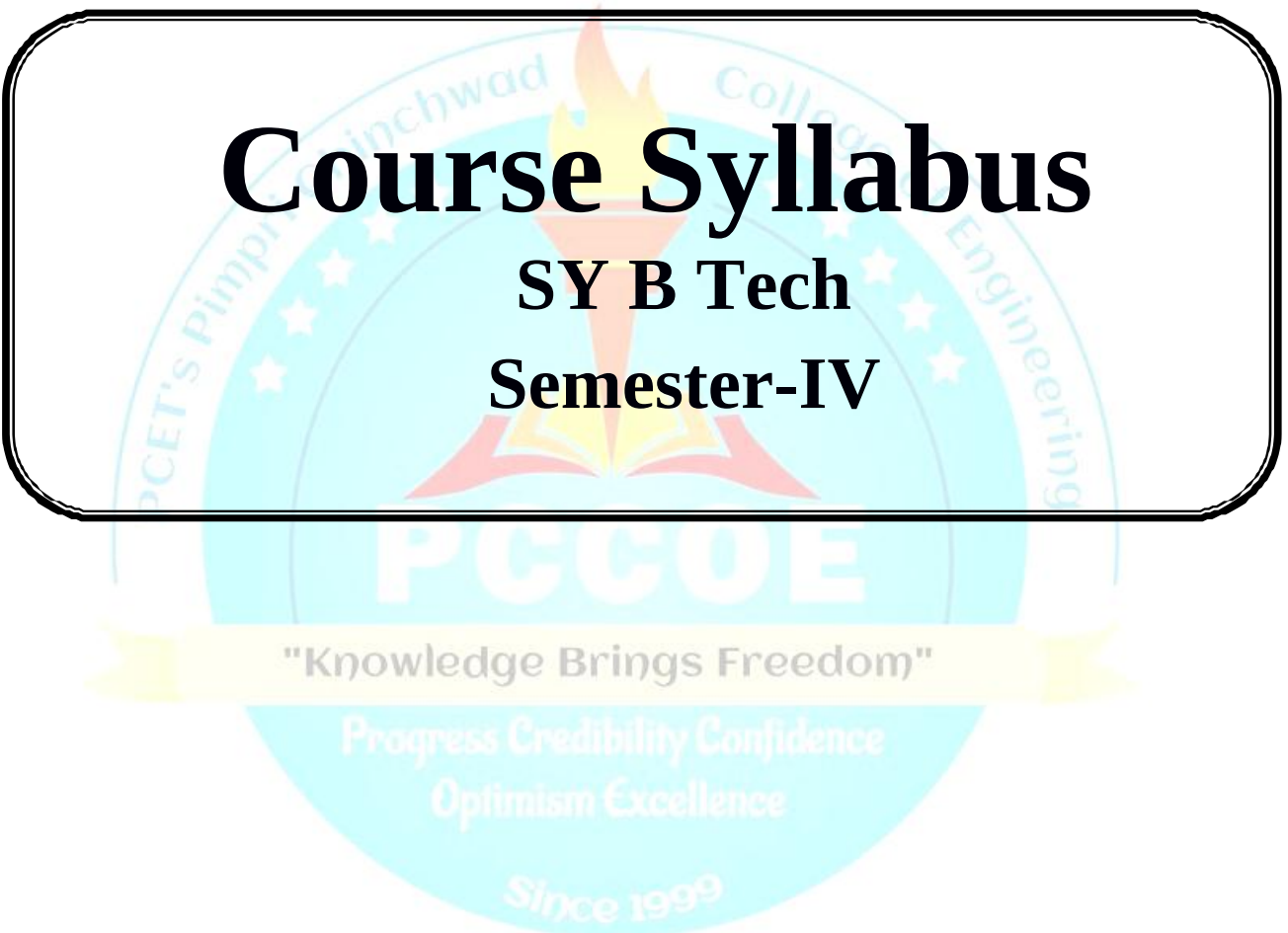
"Knowledge Brings Freedom"

**Progress Credibility Confidence
Optimism Excellence**

Since 1999

Program:	B. Tech. (All Branches)			Semester :		III	
Course:	Universal Human Values (Offered by AS&H)			Code:		BSH23VE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	-	25	25	--	50
Prior Knowledge: NIL							
Course Objectives: This course aims at enabling students, 1. To appreciate the essential complementarity 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 to lead their personal and professional lives in an ethical way. 3. To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour, and mutually enriching interaction with nature.							
Course Outcomes: After learning the course, the students should be able to: 1. Illustrate the relevance of Universal Human Values using real-life examples from personal, social, and professional contexts. 2. Interpret a human being as the co-existence of ‘Self’ and ‘Body’. 3. Apply the concept of harmony in family and society to given scenarios with appropriate value-based actions. 4. Apply Universal Human Values to promote coexistence with nature in personal and professional life.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to Value Education: • Understanding Value Education • Self-exploration as the Process for Value Education • Continuous Happiness and Prosperity • Right Understanding • Current Scenario • Method to fulfil the Basic Human Aspirations						4
	Sharing Session: • Sharing about Oneself • Exploring Human Consciousness • Exploring Natural Acceptance						3
2	Harmony in the Human Being: • Human being: the Co-existence of the Self and the Body • 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						4
	Sharing Session: • Exploring the Difference between Needs of Self and Body • Exploring Sources of Imagination in the Self • Exploring Harmony of Self with the Body • AI Integration: Personal Habit Analysis						4
3	Harmony in the Family and in Society; • Harmony in the Family • Trust'—the Foundational Value in Relationship • Respect' – as the Right Evaluation						4

	• Other feelings (Values) in Human-to-Human Relationship • Understanding Harmony in Society • Vision for the Universal Human Order • Five Dimensions of Human Order	
	Sharing Session: • Exploring the Feeling of Trust • Exploring the Feeling of Respect and Exploring Systems to • Fulfil Human Goal	3
4	Harmony in Nature/Existence: • Understanding Harmony in Nature, • Realizing Existence as Coexistence at All Levels • The Holistic Perception of Harmony in Existence Implications of Holistic Understanding: A Look at Professional Ethics: • Definitiveness of (Ethical) Human Conduct • Humanistic Constitution and Universal Human Order • Competence in Professional Ethics • Holistic Technologies, Production Systems and Management Models -Typical Case Studies • Strategies for Transitioning towards Value-Based Life and Profession.	4
	Sharing Session: • Exploring the Four Orders of Nature • Exploring Co-existence in Existence • Exploring AI for Holistic Technologies • Exploring Humanistic Models in Education • Exploring Steps of Transition towards Universal Human Order	4
Total		30
Text Books: 1. R R Gaur, R Sangal, G P Bagaria, 2019, A Foundation Course in HUMAN VALUES and Professional Ethics- Presenting a universal approach to value education through self-exploration, Excel Books		
Reference Books: 1. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers. 2. A. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 3. A. N. Tripathy, 2003, Human Values, New Age International Publishers. 4. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press 5. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd. 6. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books. 7. B. L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.		
e-Resources 1. http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/ 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw 3. https://youtu.be/OgdNx0X923I		

The logo of PCCOE (Pimpri Chinchwad College of Engineering) is a circular emblem. It features a central torch with a flame, set against a background of a rising sun and an open book. The text "PCCOE" is prominently displayed in the center. Surrounding the emblem is a banner with the motto "Knowledge Brings Freedom". Below the banner, the words "Progress Credibility Confidence" and "Optimism Excellence" are written. At the bottom, it says "Since 1999". The entire logo is rendered in a light blue and yellow color scheme.

Course Syllabus

SY B Tech

Semester-IV

Program:	B. Tech. (Civil Engineering)				Semester :		IV	
Course:	Soil Mechanics				Code:		BCI24PC07	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	--	--	1	10	10	30	50
Prior Knowledge: 1. Knowledge of fundamentals of fluid mechanics 2. Engineering Geology								
Course Objectives: 1. To make aware of soil classification and provide the knowledge of methods for determination of index and engineering properties of soil. 2. To impart the knowledge of the soil-water interaction and the effects of static vs flowing water on soil strength. 3. To provide the knowledge of soil behavior under stress regime.								
Course Outcomes: After learning the course, the students should be able to: 1. Explain index properties of soil, permeability concepts in seepage analysis. 2. Determine the compaction parameters, vertical stress, and its influence on soil behavior. 3. Determine shear strength parameters using various tests. 4. Calculate the lateral thrust due to backfill on retaining wall, factor of safety for slope stability.								
Detailed Syllabus								
Unit	Description							Duration (H)
1	Index properties of soil and Soil water a) Introduction to geotechnical engineering and its applications to civil engineering, Three phase soil system, weight volume relationships, index properties of soil: methods of determination and their significance, IS and Unified soil classification systems. b) Permeability definition and necessity of its study, Darcy's law, factors affecting permeability, laboratory measurement of permeability: constant head method and falling head method, Seepage and seepage pressure, quick sand phenomenon, critical hydraulic gradient, flow net, properties and application.							08
2	Compaction and Stress Distribution in soils a) Introduction, comparison between compaction and consolidation, compaction tests- standard proctor test, modified proctor test, zero air void line, factors affecting compaction, effect of compaction on soil properties, field compaction methods and compaction equipment for different types of soil, placement water content, proctor needle in field compaction control. b) Boussinesq's theory with assumptions for point load and circular load (with numerical), pressure bulb and its significance, Westergaard's theory, equivalent point load method.							07
3	Shear Strength of Soil a) Mohr-Coulomb failure theory, effective stress principle- total stress, effective stress, pore water pressure, factors affecting shear strength. b) Measurement of shear strength- direct shear test, triaxial compression test, unconfined compression test, vane shear test, different drainage conditions for shear tests.							07
4	Earth Pressure and Stability of Slopes a) Earth Pressure: introduction, Rankine's state of plastic equilibrium in soils- active and passive states due to wall movement, earth Pressure at rest, Rankine's theory: earth pressure on retaining wall due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's wedge theory. b) Stability of slopes: classification of slopes and their modes of failure, Taylor's stability number.							08
Total							30	
Self –directed learning: Hydrometer method, Field identification of soils, Field permeability Tests, Newmarks Chart, Determination of Earth pressure using Rehbar's and Culmann's graphical method.								
Text Books: 1. Soil Mechanics and Foundation Engineering by B. C. Punmia, Laxmi Publications, 16th Edition, 2017. 2. Geotechnical Engineering by Shashi K. Gulhati & Manoj Datta, Tata McGraw Hill, 2017. 3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers, 2018. 4. Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publisher, 7th Edition, 2019.								

Reference Books:

1. Geotechnical Engineering by C. Venkatramaiah, New Age International Publishers, 5th Edition, 2017.
2. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition, 2020.
3. Geotechnical Engineering by P Purushothma Raj, Tata McGraw Hill, 2017.
4. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition, 2017.
5. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition, 2016.
6. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International Students Edition.

IS Codes: SP36 Compendium of Indian Standards on Soil Engineering, Part 1:1987 Laboratory Testing of soils for Civil Engineering Purposes

E-resource:

1. <http://ascelibrary.org/page/books/s-gsp>.
2. <http://accessengineeringlibrary.com/browse/geotechnical-engineersportable-handbook-second-edition>.
3. <http://nptel.ac.in/courses/105101084/>
4. <http://nptel.ac.in/courses/105106142/>



Program:	B. Tech. (Civil Engineering)			Semester :	IV		
Course:	Soil Mechanics Lab			Code:	BCI24PC08		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	--	02	--	50	25	--	75

Course Objectives:
To make aware of soil classification and provide the knowledge of methods for determination of index and engineering properties of soil.

Course Outcomes:
After learning the course, the students will be able to:

1. Determine index properties of soil.
2. Determine engineering properties of soil.
3. Calculate shear strength parameters, earth pressure using graphical methods.

Detailed Syllabus

Lab Experiments
The term work shall consist of a journal giving details of 10 out of 12 of the following experiments. Assignments are compulsory.

1. Water content determination by two methods a) oven drying method, b) calcium carbide method
2. Specific gravity determination by pycnometer.
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) core cutter b) sand replacement
6. Determination of coefficient of permeability by a) constant head and b) variable head method.
7. Direct shear test.
8. Unconfined compression test.
9. Vane shear test.
10. Standard proctor test / Modified proctor test.
11. Differential free swell test.
12. Triaxial test

Assignments:

1. Solution of problems on shear strength parameters using graph.
2. Rehmann's and Culmann's graphical method for determination of earth pressure.
3. Flow net construction for sheet pile or earthen dam.

Text Books:

1. Soil Mechanics and Foundation Engineering by B. C. Punmia, Laxmi Publications, 16th Edition, 2017.
2. Geotechnical Engineering by Shashi K. Gulhati & Manoj Datta, Tata McGraw Hill, 2017.
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers, 2018.
4. Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publisher, 7th Edition, 2019.
5. Foundation Design Manual by N. V. Nayak, Dhanpat Rai Publications, 7th Edition, 2019.

Reference Books:

1. Geotechnical Engineering by C. Venkatramaiah, New Age International Publishers, 5th Edition, 2017.
2. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition, 2020.
3. Geotechnical Engineering by P Purushothma Raj, Tata McGraw Hill, 2017.
4. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition, 2017.
5. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition, 2016.
6. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International Students Edition.

IS Codes: SP36 Compendium of Indian Standards on Soil Engineering, Part 1:1987 Laboratory Testing of soils for Civil Engineering Purposes

e-Resources:

1. <http://ascelibrary.org/page/books/s-gsp>.
2. <http://accessengineeringlibrary.com/browse/geotechnical-engineers-portable-handbook-second> edition.
3. <http://nptel.ac.in/courses/105101084/>
4. <http://nptel.ac.in/courses/105106142/>

Program:	B. Tech. (Civil Engineering)				Semester :		IV	
Course:	Concrete Technology				Code:		BCI24PC09	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	--	--	1	10	10	30	50
Prior Knowledge: Engineering geology and materials in construction is essential								
Course Objectives: This course aims at enabling students, 1. To make aware of properties of concrete ingredients and fresh and hardened concrete 2. To build their ability to design concrete mix. 3. To impart knowledge of concrete equipment's, special concrete and repairs of concrete.								
Course Outcomes: After learning the course, the students should be able to: 1. Explain the properties of various concrete ingredients. 2. Evaluate the various tests and properties of fresh and hardened concrete 3. Design a concrete mix as per IS guidelines and describe special concrete. 4. Explain the concrete equipment's, technique and repairing techniques for deteriorated concrete								
Detailed Syllabus								
Unit	Description							Duration (H)
1	Concrete Ingredients: a) Cement- Manufacturing, chemical composition, hydration of cement and tests on cement. Aggregate- mechanical and physical classification, properties and tests, alkali-aggregate reaction, Grading of aggregates, b) Water and admixtures: Quality of water for concrete, Function and classification of admixture, Types-i) Chemical admixtures: Plasticizers, super plasticizers, accelerators, retarders, air entraining ii) Mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag.							08
2	Properties and Tests on Fresh and Hardened Concrete: a) Factors affecting workability, segregation, effect of temperature, concept of maturity, measurement of workability using slump cone, compaction factor, Vee-Bee consistometer and flow table apparatus. b) Factors affecting concrete strength, relation between tensile and compression strength, creep and shrinkage, Destructive tests: compression strength, flexural strength and tensile strength. Nondestructive tests: core test, rebound hammer and ultrasonic pulse velocity.							07
3	Concrete Mix Design and special concretes: a) Concrete Mix Design-objectives of mix design, factors to be considered, statistical quality control, concrete mix design by IS code method. b) Special concretes: lightweight concrete, self-compacting concrete, fiber reinforced concrete, Introduction to UHPC.							07
4	Concreting Equipment's, Techniques and durability: a) Concreting Equipments: concrete mixers, pumps, vibrators and compaction equipment's. concreting techniques- Ready mix concrete, under water concreting, cold and hot weather concreting. b) Factors affecting durability and permeability, acid attack on concrete, carbonation of concrete, corrosion of reinforcement and controlling measures. Cracks in concrete and its diagnosis, common repair techniques, shotcrete and grouting.							08
Total								30
Self-directed learning: Explore the wide range of admixtures (e.g Metakaolin) and their properties, Special concretes like geopolymer concrete, recycle aggregate concrete, self-healing concrete, Sustainable concrete practices like SCM for reduced carbon footprint, durability and life cycle assessment of concrete.								
Text Books: 1. Concrete Technology by M. L. Gambhir, 5th Edition, Tata McGraw-Hill Publication, 2013. 2. Concrete Technology: Theory and practice by M. S. Shetty and A. K. Jain, 8th Edition, S Chand Publication, 2018. 3. Properties of Concrete by A. M. Neville – 5th Edition, Pearson Publication, 2012.								

Reference Books:

1. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press, 2018.
2. Concrete : Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education, 2014.
3. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd, 2017.

IS Codes:

1. IS 383:2016- Coarse and Fine Aggregate for Concrete Specification
2. IS 456:2000 with Reaffirmed 2016-Plain and Reinforced concrete- code of practice
3. IS 516 : 1959 with Reaffirmed 2018- Methods of tests for strength of concrete
4. IS 1489 (Part 1) : 2015(4 Revision)- Portland pozzolana cement - Specification: Part 1 fly Ash Based
5. IS 2386 (Part 1 to 5):1963 with Reaffirmed 2021 -Methods of Test for Aggregates for Concrete
6. IS 4031 (Part 1,10 to 13):1996 with Reaffirmed 2021 -Methods of physical tests for hydraulic cement
7. IS 9103 : 1999 (1 Revision) with Reaffirmed 2018- Specification for Concrete Admixtures
8. IS 1199 : Part 1 to 5: 2018 - Fresh Concrete Methods of Sampling, Testing and Analysis
9. IS 10262 : 2019 (2 Revision)- Concrete Mix Proportioning Guidelines
10. IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 1 Ultrasonic Pulse Velocity
11. IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 2 Rebound Hammer

E-resource:

1. <https://www.concrete.org/>
2. <https://archive.nptel.ac.in/courses/105/102/105102012/>



Program:	B. Tech. (Civil Engineering)			Semester :	IV		
Course:	Concrete Technology Lab			Code:	BCI24PC10		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
01	--	02	--	50	25	--	75
Prior Knowledge: Knowledge of fundamentals of fluid mechanics and geology is essential							
Course Objectives: To develop the ability to perform various tests and interpret results of ingredients of concrete and properties of fresh and hardened concrete.							
Course Outcomes: After learning the course, the students will be able to: 1. Evaluate the different properties of concrete ingredients. 2. Design a concrete mix as per code. 3. Analyze the test on fresh and harden concrete.							
Detailed Syllabus							
Lab Experiments Tern work and oral exam based on syllabus and following experiments. Students have to review code provisions for all the practicals and include conclusions and recommendations based on the observed readings/results and code specifications. Part A- Tests on Cement 1. Determination of standard consistency of cement paste. 2. Determination of initial and final setting times of cement and soundness of cement. 3. Determination of compressive strength of cement. Part B- Fine & coarse aggregate 4. Determination of fineness modulus of coarse and fine aggregates. 5. Moisture content, density and Specific gravity of fine aggregate 6. Moisture content , density and Specific gravity of coarse aggregate Part C- Test on Concrete 7. Workability of concrete by slump cone and compaction factor. 8. Determination of Uniaxial Compressive strength test of concrete by crushing and rebound hammer. 9. Determination of Indirect tensile strength and flexural strength of hardened concrete Assignments 10. Concrete mix design by IS code method 11. Site visit to RMC plant and preparation of report							
Text Books: 1. Concrete Technology by M. L. Gambhir, 5th Edition, Tata McGraw-Hill Publication,2013. 2. Concrete Technology: Theory and practice by M. S. Shetty and A. K. Jain, 8th Edition, S Chand Publication,2018. 3. Properties of Concrete by A. M. Neville – 5th Edition, Pearson Publication,2012.							
Reference Books: 1. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press,2018. 2. Concrete : Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education,2014. 3. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd,2017.							
IS Codes: 1. IS 383:2016- Coarse and Fine Aggregate for Concrete Specification 2. IS 456:2000 with Reaffirmed 2016-Plain and Reinforced concrete- code of practice 3. IS 516 : 1959 with Reaffirmed 2018- Methods of tests for strength of concrete 4. IS 1489 (Part 1) : 2015(4 Revision)- Portland pozzolana cement - Specification: Part 1 fly Ash Based 5. IS 2386 (Part 1 to 5):1963 with Reaffirmed 2021 -Methods of Test for Aggregates for Concrete 6. IS 4031 (Part 1,10 to 13):1996 with Reaffirmed 2021 -Methods of physical tests for hydraulic cement 7. IS 9103 : 1999 (1 Revision) with Reaffirmed 2018- Specification for Concrete Admixtures 8. IS 1199 : Part 1 to 5: 2018 - Fresh Concrete Methods of Sampling, Testing and Analysis 9. IS 10262 : 2019 (2 Revision)- Concrete Mix Proportioning Guidelines 10. IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 1Ultrasonic Pulse Velocity 11. IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 2 Rebound Hammer							

Program:	B. Tech. (Civil Engineering)				Semester :		IV	
Course:	Structural Analysis I				Code:		BCI24PC11	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	--	--	1	10	10	30	50
Prior Knowledge: Engineering Mechanics, Strength of Materials. (Equilibrium conditions, types of supports and analysis of beams, basics of slope and deflection of beams is essential)								
Course Objectives: This course aims at enabling students, 1. To impart the knowledge about the basic concepts required for analysis of structures. 2. To develop ability of analyzing structures. 3. To build concept of plastic analysis of structures.								
Course Outcomes: After learning the course, the students should be able to: 1. Analyse the determinate structures by unit load method. 2. Analyse beams and frames by slope deflection method. 3. Analyse beams and frames by moment distribution method. 4. Analyse beams and frames by stiffness matrix method.								
Detailed Syllabus								
Unit	Description							Duration (H)
1	Analysis of redundant pin jointed frames: a) Analysis of redundant trusses by unit load method for external loading, b) Lack of fit, sinking of support and temperature changes (indeterminacy up to second degree).							8
2	Slope-Deflection Method: a) Slope-deflection equations, equilibrium equation of Slope-deflection method, application of Slope deflection method to beams without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, bending moment diagram. b) Sway analysis of rigid joint rectangular single bay single storey portal frames using Slope deflection method. (Involving not more than three unknowns)							7
3	Moment Distribution Method: a) Stiffness factor, carry over factor, distribution factor, application of Moment distribution method of analysis to beams without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, bending moment diagram. b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using Moment distribution method (Involving not more than three unknowns).							8
4	Stiffness Matrix Method: a) Fundamental concepts of flexibility and stiffness, relation between them. Stiffness method of analysis- Structure approach only. Application to beams (Involving not morethan three unknowns). b) Application of Stiffness structure approach to rigid jointed rectangular portal frames (Involving not more than three unknowns).							7
Total								30
Self –directed learning- Practice of solving the Numericals on analysis of truss by unit load method, analysis of beams and frames by slope-deflection, moment distribution, stiffness matrix method								
Text Books: 1. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company (P) Ltd. 2. Structural Analysis-I & II by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd, 4 th Edition, 2014 3. Structural Analysis: A Matrix Approach by G.S.Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Limited, 2 nd Edition, 2016								

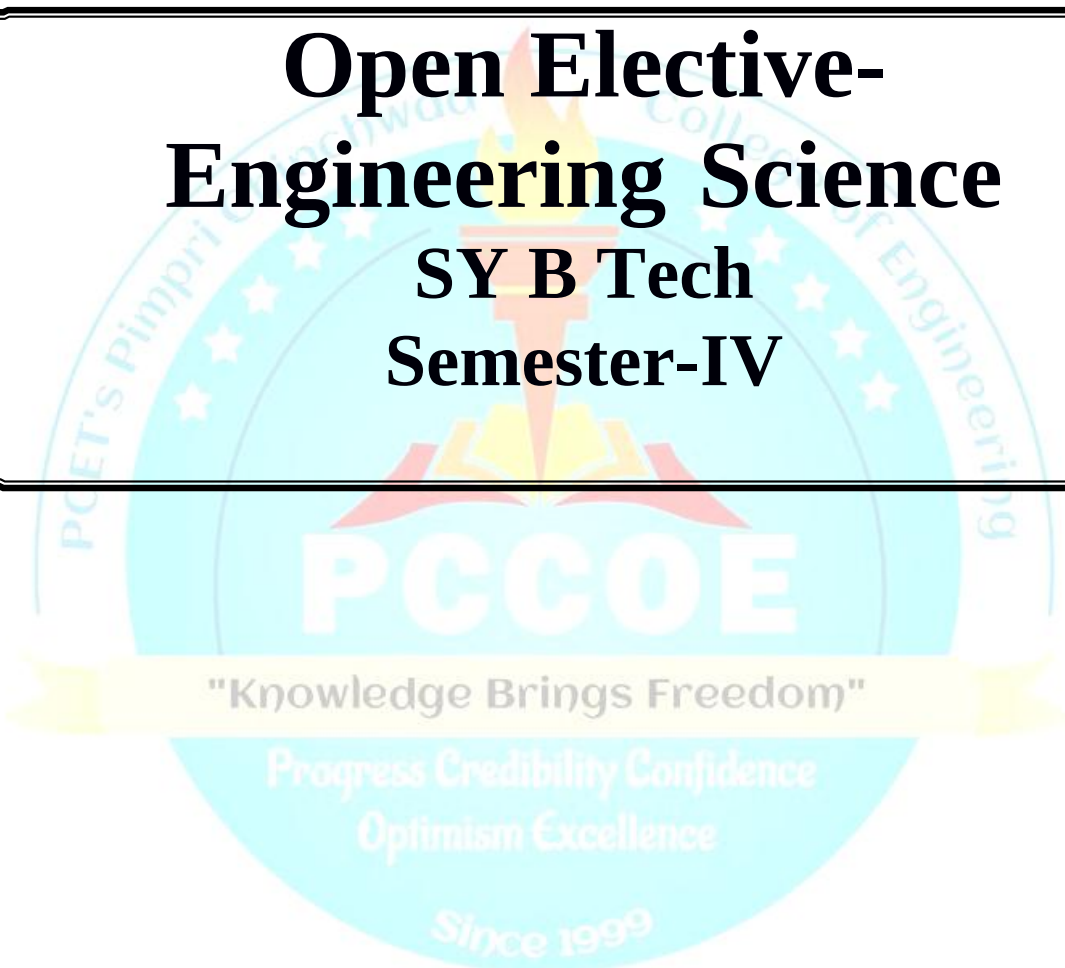
Reference Books:

1. Intermediate Structural Analysis by C. K. Wang, Tata McGraw Hill Education Pvt. Ltd. 7th Edition, 2013
2. Mechanics of Structures Vol. II (Theory and Analysis of Structures) by Dr. H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd, 23rd Edition, 2013
3. Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill Education Pvt. Ltd.
4. Structural Analysis by R. C. Hibbler, Pearson Education. 3rd Edition, 2013
5. The Plastic Methods of Structural Analysis by B. G. Neal, Chapman & Hall.
6. Structural Analysis by Aslam Kassimali, Cengage Learning India Private Limited
7. Matrix Analysis of Framed Structures by William Weaver Jr. and James M. Gere, Springer US.

e-Resources:

1. <https://nptel.ac.in/courses/105/101/105101086/>
2. <https://nptel.ac.in/courses/105/106/105106050/>



The logo of PCCOE (Pune College of Civil Engineering) is a circular emblem. It features a central torch with a flame, set against a background of a blue sky with white stars. The text "PCCOE" is prominently displayed in the center. Below it, a yellow banner reads "Knowledge Brings Freedom". Further down, the words "Progress Credibility Confidence" and "Optimism Excellence" are written. At the bottom, it says "Since 1999". The entire logo is partially obscured by a large, rounded rectangular box containing the course title.

Open Elective- Engineering Science SY B Tech Semester-IV

Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Statistical Data Analysis Using R (OE-Engineering Science offered by AS&H)			Code:		BSH24OE04	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50

Prior Knowledge: Basics of Statistics and Probability

Course Objectives: After completion of the course, students will have an adequate background, conceptual clarity, and knowledge of mathematical principles related to data, preprocessing techniques for data visualization, and statistical techniques for prediction and decision-making.

Course Outcomes: After learning the course, the students should be able to:

1. Apply R software and data handling techniques for the given data
2. Apply data pre-processing techniques to clean and transform datasets.
3. Draw inferences from data using appropriate visualization techniques.
4. Analyse the data for decision-making using statistical methods.

Detailed Syllabus

Unit	Description	Duration (H)
1	Fundamentals of R Software for Data Introduction to Data: Definition, Types and Properties, R Packages for Data Science, Importing and Exporting Data in R Software, Accessing Databases with R Software.	7
2	Data Wrangling Pre-processing Data in R Software, Dealing with Missing Values in R Software, Data Formatting in R Software, Data Normalization in R Software, Binning in R Software, and Conversion of type of data	7
3	Data Visualization Data visualisation for various data categories like Categorical, Numerical, or both using plots like Histogram, Bar/ Line Chart, Box Plots (including group-by option), Scatter Plots, Mosaic Plot, etc., and their interpretations	8
4	Data Analysis Sampling, Descriptive Statistics, Linear regression and Multiple linear regression. Model evaluation using visualization, prediction, and decision-making.	8
Total		30

Reference Books:

1. Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India, 6 Edition, ISBN: 9788126562947.
2. R. Johnson, "Probability and Statistics for Engineers", Prentice India Ltd, 8 Edition, ISBN 13:978-8120342132.
3. S.P. Gupta, "Statistical Methods", Paperback publication, 43 edition, ISBN: 9788180549892, 8180549895.
4. Victor A. Bloomfield, "Using R for Numerical Analysis in Science and Engineering", CRC Press, First Edition, ISBN: 9781315360492

e-Resources:

1. <https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB> (Probability)
2. <https://nptel.ac.in/courses/111104100> (Introduction to R software)
3. <https://www.youtube.com/watch?v=WbKiJe5OkUU&list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz> (Descriptive statistics using R software)

Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Advanced Materials and Characterizations (OE-Engineering Science offered by AS&H)			Code:		BSH24OE05	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	2	10	10	30	50

Prior Knowledge: basic physics, chemistry and nanotechnology

Course Objectives: After Completing this course, student will have adequate background :

1. To learn the principles of advanced materials, technologies and characterizations.
2. To undertake research projects with applications of advanced materials.

Course Outcomes: After learning the course, the students should be able to:

1. Interpret structure, properties and applications of advance engineering materials.
2. Explain the properties and requirements of materials for some advanced applications
3. Analyze structural, optical, elemental & morphological properties of the materials
4. Interpret electrochemical & thermal properties of the materials

Detailed Syllabus

Unit	Description	Duration (H)
1	Engineering Materials: Polymer Composite eg. fiber- reinforced polymer (FRP) composites Advanced carbon materials eg. Graphene & CNT Alloys: a] Nano alloy eg. Cu-Ni nano alloy b] Memory alloy-Nitinol CdSe Thin films for solar cells.	7
2	Materials for Special applications: Battery and Supercapacitor: working principles, components, material requirement and properties of electrodes, electrolytes and spacers, Superconductors: Metallic, nonmetallic and ceramic superconductors, Applications, Gas Sensing: working principle and required material properties. Substrate Materials for quantum computer, Invar and Elinvar Materials: properties and applications, 2D materials: properties and their applications	7
3	Structural, Optical, Elemental & Morphological Characterizations : X-Ray Diffraction and phase identification, indexing lattice parameter determination, Grain size analysis, EDAX, Electron microscopy, scanning electron microscopy, Transmission electron microscopy (TEM), Fourier Transform Infrared Spectroscopy, Band gap measurements-UV Vis- IR Spectroscopy	8
4	Electrochemical and Thermal Characterizations: Cyclic voltammetry: Instrumentation, current potential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms, charging-discharging behaviors of supercapacitor and batteries. Thermo-gravimetric analysis (TGA), Differential thermal analysis (DTA) analysis, Thermal expansion measurements, Thermal conductivity measurements, Ionic conductivity measurements. Specific heat capacity measurements, Debye temperature measurements	8
Total		30

Text Books:

1. Transmission electron microscopy: a textbook for materials science, David B. Williams, C. Barry Carter, Springer, 2009
2. Advanced solid state physics-Graduate Texts in Condensed Matter, Hendrik Bluhm, Thomas Brückel, Markus Morgenstern, Gero Plessen, Christoph Stampfer, de Gruyter 2019

Reference Books:

1. Elements of X-ray Diffraction, B.D. Culity and S.R. Stock, Pearson Publication, Third edition 2014.
2. Introduction to Fuel Cells, Electrochemistry and Materials, San Ping Jiang, Qingfeng Li, Springer Publication, 2022.
3. Solid State Physics, S.O.Pilli, New age, International Publication Tenth edition 2022.
4. Introduction to Solid State Physics, C. Kittel, 8th edition Wiley, 2005.
5. Introduction to Superconductivity, Michael Tinkham, 2nd edition, Dover Publication 2004.
6. Electrochemical super capacitors, B. E. Conway, Springer, 1999.
7. Spectroscopy, G.R. Chatwal and S.K. Ananad, Himalaya Publications, 2016.
8. Introduction to Thermal Analysis, M.E. Brown, Kluwer academic Publishers, 2nd edition 2001.

9. Electrochemical Methods: Fundamentals and Applications, A, J Bard, Allen J. Bard, Larry R. Faulkner, Henry S. White, John Wiley & Sons, 31 May 2022.
10. Microscopy A Very Short Introduction by Srivastava, Oxford University Press, 2015.
11. Practical Guide to materials Characterization, Khalid Sultan, Wiley-VCH, 2023
12. Engineering Chemistry by Wiley India Pvt.Ltd, First edition 2011.
13. Introduction to Nanotechnology by Charles P. Poole, Frank Owens, John Wiley & Sons (2003)
14. Gas Sensing Fundamentals- Springer Series on Chemical Sensors and Biosensors- Claus-Dieter Kohl, Thorsten Wagner, Springer 2014

e-sources: <https://archive.nptel.ac.in/courses/113/106/113106034/>



Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Data Science (OE-Engineering Science offered by CSE (AI &ML))			Code:		BCS24OE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50
Prior Knowledge: NIL							
Course Objectives: This course aims at enabling students, 1. To demonstrate the use of mathematical techniques in the field of data science. 2. To explain the theory of statistics for its use in statistical inference. 3. To perform the data preprocessing operations. 4. To demonstrate the use of data visualization and data analytics techniques							
Course Outcomes: After learning the course, the students should be able to: 1. Understand data science life cycle phases and analyze the need of data preprocessing 2. Analyze the need for data visualization and apply descriptive/inferential statistics for data analysis. 3. Solve the regression/classification problem for data analysis and apply the model evaluation techniques using different performance measures. 4. Apply data science in various domains.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to Data Science and Data Preprocessing: Introduction to Data Science: Data Science Life Cycle, Data Analytics and Types, Key performance indicators of data science projects. Data Preprocessing: Need, preprocessing techniques for: handling redundant data, data transformation, replacing or handling missing data, and handling data inconsistency.						8
2	Data Visualization and Hypothesis Testing: Data Visualization: Introduction, need, Data visualization techniques: line plot, scatter plot, histogram, density plot, box plot, bar plot, pie chart, heatmap, etc. Statistics and Inference – Measures of central tendency, Measures of variability: standard deviation, variance, quartiles, Interquartile range. Skewness and Kurtosis. Sampling and Inference - Sampling: Introduction, types of sampling. Hypothesis testing, types of errors, level of significance, test of hypothesis: t-test, z-test, Correlation analysis: Pearson's correlation coefficient.						8
3	Model Evaluation for Regression and Classification : Performing a linear Regression: Linear function, Fitting the line, residual errors, coefficient of determination. Performing a logistic Regression: Logistic function, fitting the curve, understanding the log-odds, R-Squared. Performing classification: Naive Bayes classifier. Model Evaluation and Selection: holdout method, random sub-sampling, cross-validation. Model's parameter tuning and optimization. Performance metrics for evaluation of model, confusion matrix, AUC-ROC analysis						8
4	Applications of Data Science: Case study on Smart cities: the role of Internet of Things and machine learning, Energy consumption: Machine Learning models for energy consumption forecasting , Supply Chain: Supply chain optimization using machine learning , Finance : Fraud detection and prevention in finance, Healthcare: Machine learning for Breast cancer prediction						6
Total							30

Text Books:

1. Thomas Nield, “Essential Math for Data Science”, O'Reilly Media Inc., October 2022, ISBN: 9781098102869.
2. Data Science and Big Data Analytics, EMC education services, Wiley publication, 2015, ISBN: 9781118876138.

Reference Books:

1. Peter Bruce, Andrew Bruce, Peter Gedeck, “Practical Statistics for Data Scientists”, O'Reilly Media, 2nd edition, May 2020, ISBN: 9781492072942.
2. Norman Matloff, “Probability and Statistics for Data Science”, CRC Press, 2019, ISBN: 9780429687112

e-sources:

1. NPTEL Course on “Python for Data Science” :https://onlinecourses.nptel.ac.in/noc22_cs74/preview
2. NPTEL Course on “Data Science for Engineers” :https://onlinecourses.nptel.ac.in/noc22_cs72/preview



Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Electrical Machines (OE- OE-Engineering Science offered by E&TC)			Code:		BET24OE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior Knowledge: of electromagnetism & electrical parameters							
Course Objectives: 1. To impart basic knowledge for conceptual understanding of DC machines. 2. To explore the construction and performance characteristics of three phase AC machines. 3. To explore the construction and performance characteristics of single-phase AC machines. 4. To relate the applications of electrical machines to practical and industrial scenarios.							
Course Outcomes: After learning the course, the students will be able to: 1. Describe the constructional features and working principles of DC Machines. 2. Explain the constructional features and operation of three phase induction motors 3. Explain the constructional features and operation single phase induction motors 4. Relate the applications of electrical machines to their respective fields of study and industrial applications.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to Electrical Machines: Overview of electrical machines and their significance, Classification of electrical machines, Fundamental principles: Faraday's Law, Lenz's Law, and Electromagnetic Induction. DC Machines Working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics, Necessity of a starter for DC motor, Speed control methods of DC shunt and DC series motor and industrial applications.						8
2	Three phase induction motor – constructional features, working principle, Rotating magnetic field, slip ring and cage types. slip, phasor diagram, expression for mechanical power and torque, torque-slip characteristics, starting torque, full load and pull-out torque, equivalent circuit. Industrial applications.						7
3	Single phase induction motors: Construction of single-phase induction motor, double field revolving theory. Types of single-phase induction motors: Split phase and shaded pole type induction motors, applications. Specifications of induction motors (KW rating, rated voltage, current rating, frequency, speed, class of insulation)						8
4	Special Purpose Motors: Construction, principle of working, characteristics ratings and applications of Brush less D.C. motors, Stepper motors (permanent magnet and variable reluctance type only), Permanent Magnet motor (A.C. & D.C.), SRM Switch reluctance motor.						7
Total							30
Text Books: 1. V. N. Mittal and Arvind Mittal, "Basic Electrical Engineering" , 2nd Edition. (McGraw-Hill), 2010 2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010							
Reference Books: 1. J.B. Gupta, "Theory and Performance of Electrical Machines," S.K. Kataria & Sons. 2. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electric Machinery," McGraw-Hill Education. 3. D. C. Kulshreshtha, "Basic Electrical Engineering" , 1st Edition (Tata McGraw hill), 2009 4. B. L. Theraja and A. K. Theraja S. Chand & Co. Pvt. Ltd. New Delhi, "A textbook of Electrical Technology Vol II", 2020							
e-sources: 1. Electrical Machines – I- https://onlinecourses.nptel.ac.in/noc20_ee60/preview 2. Electrical Machines – I- https://archive.nptel.ac.in/courses/108/105/108105017/							

Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Introduction to Signals and Systems (OE-Engineering Science offered by E&TC)			Code:		BET24OE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	-	-	10	10	30	50
Prior Knowledge: of Linear Algebra & Differential Calculus							
Course Objectives: This course aims at enabling students, 1. To develop an understanding of students related to signal representation, classification, and operations. 2. To build the understanding of analyzing and classifying the systems and their applications 3. To apply the basic concept of Fourier transform and Laplace transform to the systems							
Course Outcomes: After learning the course, the students will be able to: 1. Represent, classify, and perform the operation on signals 2. Classify the system and utilize convolution for system analysis 3. Apply the basics of Fourier transform to analyze the signal in frequency domain 4. Apply the basics of the Laplace transform to analyze the signal in a complex frequency domain.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to Signals: Representation of Standard signals, Classification of signals: Continuous-time and discrete-time signals, Periodic Signals and non-periodic, Operations on signals: Time shifting, Time reversal, Time scaling, Amplitude scaling, Signal addition, Subtraction, Signal multiplication.						7
2	Introduction to System: System Definition and Application, Classification of Systems: Continuous-time and Discrete-time systems, Linear and Non-Linear systems, Time variant and Time-invariant systems, Stable and Unstable systems, Causal systems, and non-causal systems. Convolution sum using graphical method.						7
3	Fourier Transform: Fourier Transform (FT) representation of aperiodic continuous time (CT) signals, Evaluation of magnitude and phase response, FT of standard CT signals, Application of Fourier transform						8
4	Laplace Transform and Z Transform: Definition of Laplace Transform (LT), ROC, Laplace transform of standard periodic and aperiodic functions, Inverse Laplace transform, Application of Laplace transforms.						8
						Total	30
Text Books: 1. A.V. Oppenheim, A.S. Willsky —Signals and systems, Prentice-Hall signal processing series. 2nd Edition, 2015 2. A. Nagoor Kanni —Signals and Systems, McGraw Hill, 2nd Edition, 2017							
Reference Books: 1. B P Lathi —Linear Systems and Signals, Oxford University Press, Third Edition, 2017 2. Simon Haykins and Barry Van Veen —Signals and Systems, Wiley India, 2nd Edition. 2017 3. M.J. Roberts —Signal and Systems, Tata McGraw Hill, Third Edition, 2019. 4. Charles Phillips —Signals, Systems and Transforms, Pearson Education, 4th Edition. 2013 5. R. J. Beerends, H. G. ter Morsche —Fourier and Laplace Transforms, Cambridge University Press, 2003. 6. Shaila Dinkar Apte, Signals and System, Cambridge University Press, Edition 1, 2018							
e-sources: 1. https://onlinecourses.nptel.ac.in/noc23_ee14/preview 2. https://www.classcentral.com/course/engineering-iitbombay-signals-and-systems-part-1-2679							

Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Operating System's Administration (OE-Engineering Science offered by IT)			Code:		BIT24OE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50
Prior Knowledge: Computer Programming							
Course Objectives: This course aims at enabling students, 1. To learn and understand basics of Operating Systems including Boot process. 2. To learn and understand Shells, Scripts and File System 3. To introduce the administrative features of Operating System							
Course Outcomes: After learning the course, the students should be able to: 1. Explain basic knowledge of Unix /Linux Operating System 2. Apply basic shell scripts and admin commands for Operating System tasks. 3. Make use of process controlling and monitoring commands and network monitoring 4. Experiment the administrative features of Linux Operating System							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to Operating System General Overview: History of Linux/Unix, System Structure, User perspective, Operating system Services, Assumptions about Hardware Introduction to Kernel: Architecture of Unix operating system, Introduction to the system concepts, Kernel data structure, System Administration						6
2	Bootstrapping, Booting PCs, GRUB, Booting with single user mode, Rebooting and Shutting down. Shell Basics, bash scripting, Scripting Best Practices, Working with Startup Scripts.						8
3	Access Control and Controlling Processes Components of a process, the lifecycle of a process, Signals, Kill, Process states, nice and renice, ps, Dynamic monitoring with top, prstat and topas, the /proc file system Network Administration: Network Monitoring, Network Management						8
4	Adding New Users and Storage The /etc/passwd file, The /etc/shadow and /etc/security/passwd files, /etc/group file, Adding users, Adding users with useradd Storage: Adding a hard Disk, Storage Hardware, Storage hardware Interfaces, Software aspects of storage, Formatting, Disk Partitioning, RAID Linux File System: The ext family, file system terminology, file system polymorphism, mkfs, fsck, file system mounting, setup for automatic mounting, USB drive mounting						8
Total							30
Text Books: 1. Maurice J. Bach. The Design of the Unix Operating System. Prentice-Hall 2. Evi Nemeth, Garth Snyder, Tren Hein, Ben Whaley. Unix and Linux System Administration Handbook. Fourth Edition, 2011.							
Reference Books: 1. Sumitabha Das. Unix: Concepts and Applications. 4 th Edition, McGraw Hill Education, 2017.							
e-resources: 1. https://www.coursera.org/learn/system-administration-it-infrastructure-services							

Program:	B. Tech. (Civil Engineering)			Semester :		III/IV	
Course:	Material Science (OE-Engineering Science offered by Mech)			Code:		BME23OE01/ BME24OE01	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50
Prior Knowledge: Nil							
Course Objectives: This course aims at enabling students, 1. To Acquaint students about materials, their properties, and structure property relationship. 2. To create awareness about the importance of materials information in engineering.							
Course Outcomes: After learning the course, the students should be able to: 1. Compare different materials based on their structures. 2. Relate the structure of materials with their properties. 3. Understand the structure and properties of metals, polymers, ceramics and composites. 4. Explore advanced materials in engineering applications.							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Introduction to materials: Classification of materials, structure of materials :Atomic structure, crystal structure and microstructure, material properties: Physical, Mechanical, Electrical, Magnetic etc.						8
2	Metals: Ferrous, non ferrous, alloys, structure and properties of commonly used metals, applications of metals in engineering.						7
3	Polymers: Structure of polymers and their properties, Thermoplastic and thermosetting plastics, advanced polymers such as temperature resistant polymers, shape change polymers, conducting polymers Ceramics: Structure of ceramics and their thermal, electrical and magnetic properties, applications of ceramics in engineering.						8
4	Composites: Classification of composite materials and their applications. Processing of advanced materials such as semiconductors.						7
Total						30	
Text Books: 1. Material Science and Engineering An Introduction, William D. Callister, Wiley Publication,10 th Edition 2009. 2. Material Science and Metallurgy, Dr. V. D. Kodgire, Everest publishing house, 45th Edition, 2021.							
Reference Books: 1. Materials for Engineering, John Martin, Woodhead Publishing Limited, CRC Press, 3 rd Edition, 2006.							
e-resources: NPTEL Course : Nature and properties of materials (https://onlinecourses.nptel.ac.in/noc20_me13/course) NPTEL Course : Properties of materials (https://onlinecourses.nptel.ac.in/noc20_mm13/course)							

Program:	B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Drawing for Engineers (OE-Engineering Science offered by Mech)			Code:		BME24OE02	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50
Prior Knowledge: Nil							
Course Objectives: 1. Develop imagination of physical objects for communication of Engineering Drawing. 2. Develop the interpretation and manual drawing skills. 3. Develop the physical realization of the dimension of the objects.							
Course Outcomes: After learning the course, the students will be able to: 1. Understand the basics of Engineering Graphics and apply the concepts in real life applications 2. Analyze 3D engineering objects and draw orthographic projections 3. Analyze 2D views of engineering objects and draw isometric views 4. Analyze 3D objects and draw development of lateral surfaces of solid							
Detailed Syllabus							
Unit	Description						Duration (H)
1	Part A: Introduction to engineering drawing Importance of engineering drawing to Civil, Electrical, Electronics, IT and Computer Engineers, introduction to drawing instrument and their uses, drawing sheet layout and its sizes, types of lines and their applications, dimensioning terminology and methods Part B: Projection of Points, Lines and Planes Projection: Introduction to projection and different methods of projections, Projection of Point: Introduction, Point situated in all the quadrants. Projection of lines: Introduction, Projection of lines. Projection of Planes: Introduction, Types of planes, Projection of planes. CPU circuit diagram, Electrical/Electronic board circuit diagram, Building floor plan						8
2	Orthographic projections Orthographic projection of given real life components by first angle method of projection, types of sections.						7
3	Isometric view Isometric axes, scale, difference between isometric projection and isometric view, isometric view of simple solids and its dimensioning.						8
4	Development of lateral surface of solids Development of lateral surfaces of prism, pyramid, cylinder and cone. 3D and 2D drawing of branch specific industrial products and its lateral surface development.						7
Total						30	
Text Books: 1. Engineering Drawing with an introduction to AutoCAD- Dhananjay A. Jolhe, Revised Edition 2017, Tata McGraw Hill publishing company Ltd. New Delhi, India 2. Engineering Drawing, Plane and solid geometry- N. D.Bhatt, 54 th edition 2023, Charotor publication house.							
Reference Books: 1. Engineering Drawing- M.B Shah and B.C Rana, 2 nd edition 2009, Pearson Publications. 2. Engineering Graphics- P.J. Shah, Revised edition 2019, S Chand Publications. 3. Fundamentals of Engineering Drawing- Warren J. Luzzader, 11 th edition 2015, Prentice Hall of India New Delhi. 4. A text book of Engineering Drawing- R.K. Dhawan, Revised Edition 2019, S. Chand and company ltd. New Delhi, India							

Program:	B. Tech. (Civil Engineering)			Semester :		III/IV	
Course:	Fundamentals of Mechanical Components and Systems (OE-Engineering Science offered by Mech)			Code:		BME23OE03/ BME24OE03	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
02	02	--	--	10	10	30	50

Prior Knowledge: Nil

Course Objectives: This course aims at enabling students,

1. Impart knowledge of mechanical engineering and describe the scope of mechanical engineering with multidisciplinary industries.
2. Impart knowledge of basic concepts of thermodynamics and heat transfer applied to industrial applications.
3. Understand, identify and get exposure to latest trends in manufacturing processes and materials.
4. Describe the fundamentals of automobile systems and the emerging trends of electric vehicles, hybrid electric vehicles and solar vehicles.

Course Outcomes: After learning the course, the students should be able to:

1. Identify different materials and manufacturing processes for different applications.
2. Apply the fundamentals of thermodynamics and heat transfer to real life applications.
3. Identify the basic mechanical elements and the power transmission drives based on their applications.
4. Comprehend automotive system for the combustion vehicle, EV's, HEV's and solar vehicles

Detailed Syllabus

Unit	Description	Duration (H)
1	Materials and Manufacturing Engineering Classification of materials, their properties and applications, phase change material (PCM), composite material. Introduction to manufacturing processes: classification and applications, sheet metal working and forging. Introduction to industry 4.0.	8
2	Thermal Engineering Introduction to thermodynamics: concept of a system, types of systems, energy interactions: heat and work, laws of thermodynamics, entropy, and modes of heat transfer, thermal resistance, insulation. Applications of hydraulic turbines, centrifugal pumps, compressor, household refrigerator, window and split air conditioner.	7
3	Fundamentals of Design Engineering Introduction to mechanical engineering: use of mechanical engineering in day to day life and its interdisciplinary use, Introduction to design thinking. Machine elements, power transmission drives and mechanisms.	8
4	Automotive Engineering Classification of automobile, specifications of two wheeler, four wheeler and multi axle vehicles, types of chassis layout and drives, working of I.C. Engine, gear boxes, clutch, brakes, drive train system. Emission standards. Concept and environmental importance of electric vehicles (EV), construction and working of EV, hybrid electric vehicles (HEV) and solar vehicles, challenges and future scope of EV's and HEV's.	7
Total		30

Text Books:

1. Basic Mechanical Engineering- Basant Agarwal and C. M. Agarwal, Wiley publication, First edition, (2008).
2. Engineering Thermodynamics- P. K. Nag, Tata McGraw-Hill publishing Co. Ltd., Sixth edition, (2017).
3. Heat and mass transfer- R. K. Rajput, S Chand publication, Revised edition, (2007).
4. A Textbook of Automobile Engineering- Khalil U Siddiqui, New Age International Publishers, Fifth edition, (2012).

Reference Books:

1. Design of Machine Elements- V. B. Bhandari, Tata McGraw-Hill publishing Co. Ltd., Fourth edition, (2017).
2. Theory of Machine- S. S. Ratan, Tata McGraw-Hill publishing Co. Ltd., Fifth edition, (2019).
3. Thermal Engineering- Arora and Domkunwar, Dhanpat Rai and Sons, Sixth edition, (2013).
4. Elements of Workshop Technology- Hajra, Chaudhari Volume I, Media Promoters and Publishers, Mumbai, Fourteenth edition, (2008).
5. Elements of Workshop Technology- Hajra, Chaudhari Volume II, Media Promoters and Publishers, Mumbai, Twelfth edition, (2007).
6. Handbook of Industry 4.0 and SMART Systems- Diego Galar Pascual, Pasquale Daponte, Uday Kumar, CRC Press, First edition, (2019).
7. Industry 4.0 - Dr. Bhushan Kelkar, Neuflex Publication, First edition, (2019).
8. Automobile Engineering Volume I- Dr. Kripal Singh, Standard Publishers Distributors, Eleventh edition, (2008).
9. Automation, production systems computer integrated manufacturing- Mikell Groover, Pearson Publication, Fourth edition, (2014).
10. Automotive Electrical Equipment- P. L. Kohli, McGraw Hill Education (India) Pvt Ltd., First edition, (2001).



Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Community Engagement Project			Code:	BCI24EL01		
Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
Credit	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	100	-	-	100
Course Objectives: 1. To identify the challenges and problems in rural and urban sector related to environment and explore solutions for the same. 2. To apply classroom knowledge of courses to filed realities and thereby improve quality of learning.							
Course Outcomes: After learning the course, the students should be able to: 1. Apply technical knowledge to understand the rural and urban life, culture and social realities. 2. Identify the environmental challenge and conceptualize its practical solution for societal benefits.							
Detailed Syllabus							
1. The project group consisting of maximum 5/6 students in one group in one batch. 2. The project group should select the rural/urban area and identify the environmental challenge that can be worked upon. 3. Presentation including the initial work for the problem identification, data collection and exploring of the solutions to be presented and get approved from the faculty. 4. Working on the solution identified for the challenge to be continuously worked upon and to be monitored during practical hours called as progress by faculty. 5. The evaluation to be done in three instances Review -I of 25 marks, Review-2 of 25 marks and Review 3 for 25 marks and project report 25 marks. 6. A project report to be submitted as the part of the TW completion to respective faculty. Few of the suggested areas but not limited can be consider for topic selection- 1. Air Quality Monitoring System 2. Smart Waste Management 3. Water Quality Monitoring and Management 4. Smart Irrigation System 5. Forest Fire Detection and Prevention 6. Noise Pollution Monitoring 7. Green Building Monitoring 8. Urban Heat Island Mitigation 9. Biodiversity Monitoring and Conservation 10. Community Solar Power Grid 11. River and Flood Monitoring System 12. Smart Green Transportation 13. Environmental Education Platform 14. Community Garden Automation 15. Sustainable Community Development Dashboard 16. Sewage engineering 17. Public health engineering 18. Wastewater engineering 19. Sanitary engineering 20. Non-conventional energy engineering. 21. Smart cities.							
Text Books: 1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., —Environmental Encyclopedial, Jaico Publications House, 1st edition, 2000, ISBN-13: 978-8172247867 2. Agarwal, K.C, —Environmental Biology, Nidhi Publishers, 2nd edition ,2008, ISBN-139788189153021							
Reference Books: 1. Bharucha Erach, —The Biodiversity of Indial, Mapin Publishing Pvt. Ltd., 1st edition, 20021, ISBN- 108188204064							
E-Resources 1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview							

Program :	B. Tech. (Civil Engineering)			Semester: IV			
Course :	Professional Development Training (Offered by AS&H)			Code :	BSH24AE05		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	100	-	-	100
Prior knowledge of: Basic Mathematics & English							
Course Objectives: This course aims at enabling students: 1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities. 2. To improve the overall professional development of students.							
Course Outcomes: After learning the course, the students will be able to: 1. Apply mathematical concepts to solve diverse numerical problems encountered in engineering, spanning arithmetic, algebra, geometry, and statistics. 2. Employ deductive reasoning, interpret data, and discern patterns to navigate complex logical puzzles and analytical challenges typical of engineering aptitude tests and professional scenarios. 3. Identify grammatical nuances, enhancing their verbal and written communication prowess essential for effective engineering discourse.							
Detailed Syllabus:							
Unit	Description						Duration [Hrs]
1	Numerical Ability-I HCF & LCM and Number System, Geometry, Ages, Allegations and Mixtures, Averages, Clocks and Calendars, Equations, Percentages, Profit and Loss, Ratios and Proportion, Series and Progressions, Time, Speed and Distance, Time and Work.						18
2	Numerical Ability-II Permutations and Combinations, Probability, Mean, Median, Mode, Standard Deviation, and Variance, Data Interpretation, Graphical Data Interpretation, Pie Charts, Tabular Data Interpretation, Simple Arithmetic Operations, Interest and Compound Interest, Linear equations, Quadratic equations, Triplets, Trigonometry						12
3	Logical Reasoning Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude.						12
4	Verbal Ability & Reading Comprehension Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Conjunctions, Sentence Selection, Contextual Vocabulary, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Jumble words & sentences. SMART Goal Setting & Career Road-map, Resume Writing & Linked-in Profile Building, Mock Interviews. Programming Language: Problem-solving & coding practice, Mock coding interviews						18
	Total						60
Text Books: 1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd. 2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.							
Reference Books: 1. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi. 2. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.							

The logo of PCCOE (Pune College of Civil Engineering) is a circular emblem. It features a central torch with a flame, surrounded by a blue ring containing the text 'PCCOE'S Pimpri Chinchwad College of Engineering'. Below the ring, the acronym 'PCCOE' is written in large, bold letters. At the bottom, a yellow banner displays the motto 'Knowledge Brings Freedom', followed by the words 'Progress Credibility Confidence' and 'Optimism Excellence' in a smaller font, and 'Since 1999' at the very bottom.

**Entrepreneurship/ Economics/
Management Course
(EEM)
SY B Tech
Semester-IV**

Program:	S. Y. B. Tech. (Civil Engineering)			Semester :		IV	
Course:	Operations Research			Code:		BCI24EM02	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	-	10	10	30	50

Prior Knowledge: Engineering Mathematics

Course Objectives: This course aims to enable students,

1. To develop the ability to formulate linear and non-linear programming problems from the data provided.
2. To develop the ability to optimize linear and non-linear programming problems.
3. To apply the knowledge of the optimization in civil engineering projects.

Course Outcomes: After learning the course, the students should be able to:

1. Formulate a linear optimization model and optimize it by the simplex method.
2. Optimize the problems related to transportation and assignment models.
3. Solve problems related to stochastic programming
4. Optimize non-linear programming problems.

Detailed Syllabus

Unit	Description	Duration (H)
1	Introduction to Operations Research and Linear Programming (a) Introduction to operations research: Introduction to optimization techniques, applications of operations research in civil engineering, introduction to linear and non-linear programming methods, formulation of linear optimization models for civil engineering applications (objective function, constraints) (b) Linear programming – Simplex Method The simplex method, method of big M, two phase method, duality	08
2	Linear Programming – Transportation Model and Assignment Model The transportation model and its variants, the assignment model and its variants	07
3	Stochastic Programming: Sequencing: n jobs through 2, 3 and M machines, queuing theory: elements of queuing system and its operating characteristics, waiting time and idle time costs, Kendall's notation, classification of Queuing models, single channel. Queuing theory: Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1): (FCFS/ ∞ / ∞), Simulation: Monte Carlo simulation.	07
4	Non- Linear Programming Single variable unconstrained optimization: sequential search techniques-dichotomous, Fibonacci, golden section. Multivariable optimization without constraints: the gradient vector and Hessian matrix, gradient techniques, steepest ascent/decent technique, Newton's Method. Multivariable optimization with equality constraints: Lagrange multiplier technique	08
Total		30

Text Books:

1. Operations Research, Premkumar Gupta and D. S. Hira, S. Chand Publications, 2011.
2. Engineering Optimization: Methods and Application, A. Ravindran and K. M. Ragsdell, Wiley India.
3. Engineering Optimization, S. S. Rao, New Age International (P) Ltd., 2023.
4. Quantitative Techniques in Management, N.D. Vohra, Mc Graw Hill, 2021.
5. Operations Research, Pannerselvam - PHI publications, 2023.

Reference Books:

1. A System Approach to Civil Engineering Planning & Design, Thomas K. Jewell - Harper Row Publishers, 1986
2. Operations Research, Hamdy A. Taha, Pearson Publication, 2019.

e-Resources

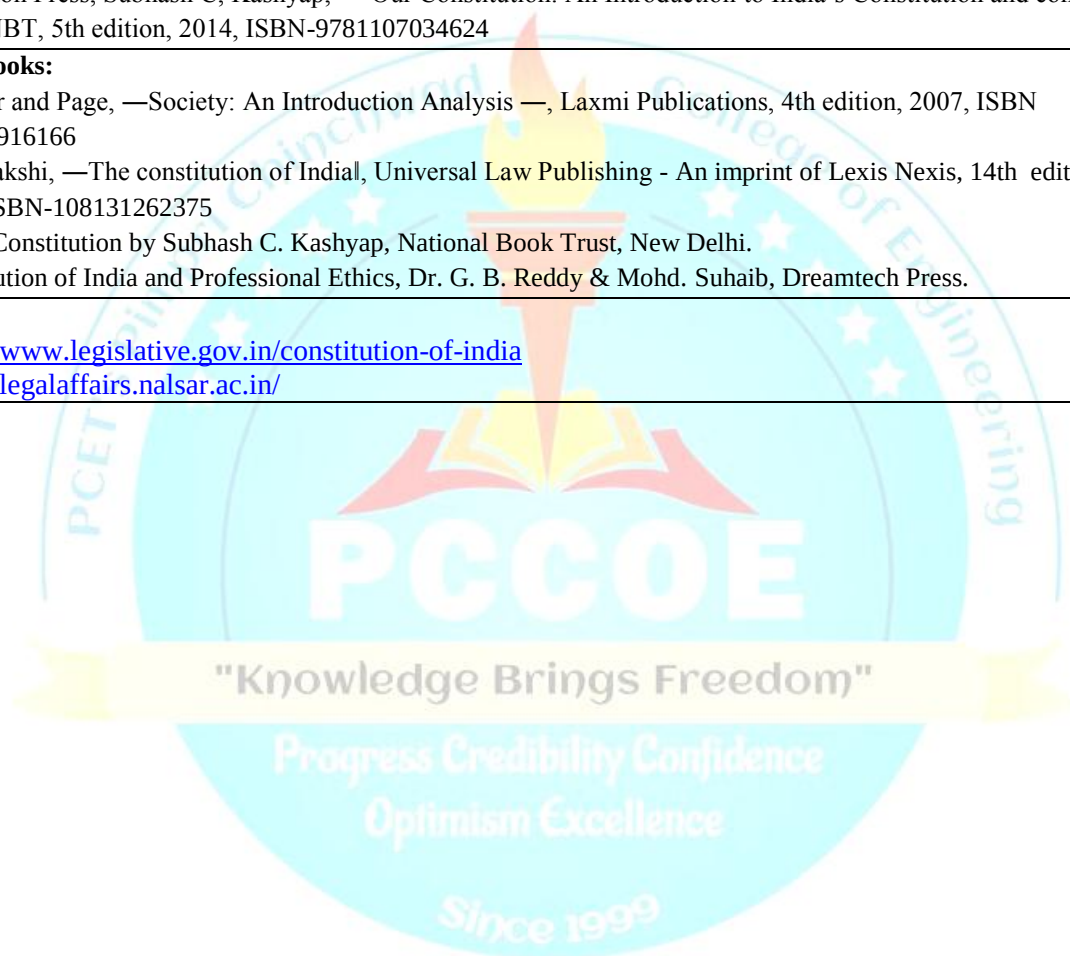
1. https://onlinecourses.nptel.ac.in/noc22_ma48/preview

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**Value Education Course
(VEC)
SY B Tech
Semester-IV**

Program:	B. Tech. (Civil Engineering)				Semester:	IV	
Course :	Constitution of India				Code:	BSH24VE02	
Credit	Teaching Scheme			Evaluation Scheme			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	-	25	25	-	50
Course Objectives:							
1. To introduce students to the fundamental principles, philosophy, and key features of the Indian Constitution. 2. To familiarize students with the structure and functioning of government and key constitutional provisions. 3. To enable students to apply constitutional values, rights, and duties in understanding contemporary issues and responsible citizenship.							
Course Outcomes:							
After learning the course, the students will be able to							
1. Explain the fundamental principles and key features of the Indian Constitution, including Preamble, Rights, Duties, and DPSP. 2. Describe the structure and functioning of the Executive, Legislature, and Judiciary, including the law-making process. 3. Illustrate constitutional provisions such as amendments, writs, and citizen mechanisms to address rights and governance issues. 4. Apply constitutional values to evaluate contemporary issues and challenges in civic and professional contexts.							
Detailed Syllabus:							
Unit	Description						Duration (Hrs)
1	Foundations of the Indian Constitution - Introduction to the Indian Constitution: brief historical background, making of the Constitution, and its significance - The Preamble: ideals, philosophy, and interpretation - Salient features of the Indian Constitution: sovereignty, secularism, democracy, federalism, and rule of law - Fundamental Rights and Fundamental Duties: concepts and relevance in contemporary society - Directive Principles of State Policy (DPSP): objectives and role in governance - Relationship between Fundamental Rights, Duties, and DPSP						7
2	Structure and Functioning of Government - Union Executive: President, Vice-President, Prime Minister, and Council of Ministers—roles and functions - Parliament: composition and functioning of Lok Sabha and Rajya Sabha - Legislative process: stages of law-making (bill to act) - Judiciary: structure, independence, and concept of judicial review - Federalism: Centre–State relations and distribution of powers - State Government: role of Governor and State Legislature (overview)						8
3	Constitutional Mechanisms and Citizen Interface - Amendment process of the Constitution and basic structure doctrine - Constitutional bodies: Election Commission of India and Comptroller and Auditor General—roles and functions - Emergency provisions: national, state, and financial emergencies - Constitutional remedies: writs and judicial remedies for protection of rights - Public Interest Litigation (PIL): concept and significance - Introduction to citizen-centric mechanisms: Right to Information (RTI)						7

4	Constitution in Contemporary Context - Judicial activism and its role in safeguarding constitutional values - Contemporary constitutional issues: freedom of speech, right to privacy, gender justice, and environmental protection - Challenges to constitutional governance: secularism, federalism, and social justice - Recent constitutional developments and amendments - Basic comparative perspective: Indian Constitution and selected global practices - Case Studies with help of artificial intelligence	8
Total		30
Text Books: - E I. Durga Das Basu, —Introduction to the Constitution of India —, Prentice Hall of India, New Delhi, 24th edition, 2020, ISBN-109388548868 - Clarendon Press, Subhash C, Kashyap, — Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 5th edition, 2014, ISBN-9781107034624		
Reference Books: - Maciver and Page, —Society: An Introduction Analysis —, Laxmi Publications, 4th edition, 2007, ISBN 100333916166 - PM Bhakshi, —The constitution of India, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375 - Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi. - Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.		
e-sources: https://www.legislative.gov.in/constitution-of-india https://legalaffairs.nalsar.ac.in/		



Vision and Mission of the Civil Engineering Department

Vision of the Civil Engineering Department

To establish as a premier civil engineering department in Maharashtra in the coming five years by providing quality education, fostering innovation with ethical values to serve the society.

Mission of the Civil Engineering Department

1. Fostering value-based education to achieve academic excellence with the right attitude and professional ethics.
2. Inculcating a culture of research and innovation, with an aim of serving society in a sustainable manner.
3. Developing skilled civil engineers with an ability to provide solutions to meet national and global challenges in accordance with the needs of the society.

Program Specific Outcomes (PSO) of Civil Engineering Department

1. Graduates in civil Engineering will demonstrate proficiency in practical applications for quality construction work in the domain of Structural Engineering, Water Resources-Environmental Engineering, Geotechnical-Transport and Construction Management.
2. A graduate in Civil Engineering, equipped with the necessary skills and technical knowledge, can become an entrepreneur in the field, capable of identifying business opportunities, developing business plans, managing resources, designing and executing sustainable construction projects for infrastructural development.