#### **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)

"Knowledge Brings Freedom"



Effective from Academic Year 2025-26 (Updated with minor changes)



### Pimpri Chinchwad Education Trust's Pimpri Chinchwad College of Engineering

#### **Course Approval Summary**

#### A) Board of Studies - Department of Civil Engineering

Sr. No.	Name of the Course		Page number	Signature and stamp of BoS chairman				
1	Building Planning and Construction	BCI23PC02	12					
2	Building Planning and Construction Lab	BCI23PC03	14					
3	Fluid Mechanics	BCI23PC04	15					
4	Fluid Mechanics Lab	BCI23PC05	17					
5	Strength of Materials	BCI23PC06	18	Que Ml				
6	Community Engagement Project	BCI23EL01	48	Quar				
7	Soil Mechanics	BCI24PC07	50					
8	Soil Mechanics Lab	BCI24PC08	52	Chairman BoS, Civil Engineering				
9	Concrete Technology	BCI24PC09	53 P	CET's, Pimpri Chinchwad College of Engineerin				
10	Concrete Technology Lab	BCI24PC10	55	Sector No. 26, Pradhikaran, Nigdi, Pune-44				
11	Structural Analysis I	BCI24PC11	56					
12	Techniques and Testing Lab in Civil Engineering	BCI24VS03	<b>570</b>	Severe 1				

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	21	
2	Computational Techniques (Suggested for E&TC branch)	BSH23OE02	23	
3	Applied Mathematics (Suggested for Mechanical branch)	BSH23OE01	25	Buch
4	Computational Techniques (Suggested for Computer and IT branches)	BSH24OE07	27	Chairman BoS, Applied Sciences & Humanities
5	Mathematical Optimization (Suggested for CSE -AIML branch)	BSH24OE08	29	PCET's, Pimpri Chinchwad College of Engineerin Sector No. 26, Pradhikaran, Nigdi, Pune-44
6	Neural Network & Fuzzy Logic Control	BSH23OE06	32	<b>3000</b>
7	Business Studies for Engineers	BSH23EM01	43	

S.Y.B.Tech(Civil Engineering), PCCoE,Pune

#### Department of Civil Engineering

8	Universal Human Values	BSH23VE01	46	
9	Statistical Data Analysis using R	BSH24OE04	59	
10	Advanced Materials & Characterizations	BSH24OE05	60	
11	Professional Development Training	BSH24AE05	72	
12	Designing Thinking & Innovation Management	BSH24EM02	74	
13	Project Management	BSH24EM03	75	
14	Fostering Entrepreneurship and Startups	BSH24EM04	77	
15	Business finance for engineers	BSH24EM05	79	
16	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	33	1 40
2	Principles of Software Engineering	BCE23OE02	34	(m)
3	Android App Development with	BCE23OE03	35	Chairman  Bos. Computer Engineering

D) Board of Studies Department of CSE(AL&MI)

PCET's, Pimpri Chinchwad College of Engineering
Sector No. 26 Pradhikaran, Nigdi, Pune-44

D) Boai	rd of Studies - Department of CSE(A.	Sector No. 26, Pragnikaran, Nigui, Puli		
Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	AI for Financial Modelling	BCS23OE01	36	
2	Data Science	BCS24OE02	62 Cha	airman, Board of Studies Juter Science & Engineering (AL&ML)

Department of E&TC

E) Boar	d of Studies - Department of E & I	, 	Sec	or 26, Pradhikaran, Pryot, Fune - 411044.
Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Biology for Engineers	BET23OE03	37	
2	Electrical Machines	BET24OE01	64	4500
3	Introduction to Signals and Systems	BET24OE02	65	Ohairman

BoS, Electronics & Telecommun cation Engineering PCET's, Pimpri Chinchwad College of Engineering Sector No. 36, Pradhikaran, Nigdi, Pune-44

PCET's Pimpri Chinchwad College of Engineering

#### Department of Civil Engineering

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	38	
2	Operating System's Administration	BIT24OE01	66	Chairman BoS, Information Technolo
				PCET's, Pimpri Chinchwad College of Ei

G) Boai	rd of Studies - Department of Me	Sector No. 26, Pradhikaran, Nigdi, Pune-44		
Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1	Industry 4.0	BME23OE04	39	
2	Energy storage management	BME23OE05	40	Max
3	Material Science	BME23OE01/ BME24OE01	67	Chairman BoS, Mechanical Engineering
4	Fundamentals of Mechanical Components and Systems	BME23OE03/ BME24OE03	68	PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune. 44

Approved by Academic Council:

PCET's, Pimpri Chinabynad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44

Chairman, Academic Council Pimpri Chinchwad College of Engineering Department of Civil Engineering

#### **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)."

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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 AND CREDIT DISTRIBUTION

Sr	Type of Course	No. of	Total Credits		
No.	Type of Course	Courses	NO.	%	
1.	Basic Science Course	8	14	8.75	
2.	Engineering Science Course	eed6m"	12	7.5	
3.	Programme Core Course	26	44	27.5	
4.	Programme Elective Course	11	20	12.5	
5.	Multidisciplinary Minor	6	14	8.75	
6.	Open Elective Course	4	8	5	
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	78	160	100	

#### SEMESTER WISE CREDIT DISTRIBUTION

Sr.	TYPE OF COURSE		NO.	OF C	OURS	ES/ SI	EMES	TER		TOTAL
No.	THE OF COURSE	1	2	3	4	5	6	7	8	TOTAL
1.	Basic Science Course	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course	7	5	-	-	-	-	-	-	12
3.	Programme Core Course	-	2	8	8	10	8	8	_	44
4.	Programme Elective Course	-	-	-	-	4	8	6	2	20
5.	Multidisciplinary Minor	-	-	2	2	4	2	4	-	14
6.	Open Elective	-	-	4	2	2	-	-	-	8
7.	Vocational and Skill Enhancement Course	2	2	-	2	-	2	-	-	8
8.	Ability Enhancement Course	-1	2	-	2	-	-	-	-	4
9.	Entrepreneurship/Economics/Managem ent Course	A To	V,	2	2		-	-	-	4
10.	Indian Knowledge System	2	-/	-		10	1	-	-	2
11.	Value Education Course	-	-	2	2	-	(	-	-	4
12.	Experiential Learning Courses	1	= 1	2	-//	2.7	1-3	4	16	22
13.	Liberal Learning Courses	2	2	-	-	1-	<u> </u>	3	-	4
	TOTAL	20	20	20	20	20	20	22	18	160

#### SEMESTER WISE COURSE DISTRIBUTION

Sr.	TWING OF COVINGE		NC	o. OF C	OURS	ES/ SE	MEST	ER		тоты
No.	TYPE OF COURSE	1	2	3	4	5	6	7	8	TOTAL
1.	Basic Science Course	4	4	-	-	4-	-	-	-	8
2.	Engineering Science Course	3	3	-	-	-	-	-	-	6
3.	Programme Core Course	Br.	ing:	5 5 r	esq	060	5	4	-	26
4.	Programme Elective Course	re-ili	niifny	Can	in <del>t</del> e)	2	4	4	1	11
5.	Multidisciplinary Minor	ain	S)(e)c	1	1	2	1	1		6
6.	Open Elective	-	-	2	1	1	-	-	-	4
7.	Vocational and Skill Enhancement Course	1,100	1	( <u>e)</u>	1	-	1	-	-	4
8.	Ability Enhancement Course	-	1	-	1	-	-	-	-	2
9.	Entrepreneurship/Economics/Managem ent 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	11	11	10	3	78

## Curriculum structure SY B Tech Civil Engineering

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#### **CURRICULUM STRUCTURE**

#### Second Year B. Tech. (Civil Engineering) (Regulations 2023) Semester-III (With effect from Academic Year 2025-26)

Course Name Code			Cro	edit	Sch	eme		Sch (Ho	chin emo urs eek)	e	Evaluation Scheme and Marks						
	Course Type		L	P	Т	Total	L	P	Т	o		A	SA	TW	PR	OR	Total
											FA1	FA2					
BCI23PC02	PCC	Building Planning and Construction	2			2	2	M		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	r		1	10	10	30				50
BCI23PC05	PCC	Fluid Mechanics Lab		1		1	١	2						50		25	75
BCI23PC06	PCC	Strength of Materials	2			2	2	1		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	3r 2	ing	gs	Fr	10	10	30				50
BSH23EM01	EEM 1	Business Studies for Engineers	2			2	2	316		2114	10	10	30				50
BSH23VE01	VEC 1	Universal Human Values	2			2	2		01		25	25					50
BCI23EL01	CEP	Community Engagement Project		2		2		4						100			100
	Tota	al	16	4		20	16	8		3	95	95	210	200		50	650

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

 $L\hbox{-} Lecture, T\hbox{-} Tutorial, P\hbox{-} Practical, H\hbox{-} Hours, CR\hbox{-} Credit, FA\hbox{-} Formative Assessment, SA\hbox{-} Summative Assessment, TW\hbox{-} Term Work, PR\hbox{-} Practical Exam, OR\hbox{-} Oral Exam$ 

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

Course Code	Course Name	
BSH23OE03	Applied Mathematics (Suggested for Civil Engineering)	
BSH23OE02	Computational Techniques (Suggested for E&TC branch)	
BSH23OE01	Applied Mathematics (Suggested for Mechanical branch)	Select
BSH24OE07	Computational Techniques (Suggested for Computer and IT branches)	any one
BSH24OE08	Optimization Techniques (Suggested for CSE -AIML branch)	

#### **List of Open Elective courses – Department Specific**

<b>Course Code</b>	Offered by	Course Name	
BSH23OE06	AS&H	Neural Network & Fuzzy Logic Control	
BCE23OE01	Computer	Fundamentals of Database Management	
/		System	
BCE23OE02	Computer	Principles of Software Engineering	
BCE23OE03	Computer	Android App Development with Kotlin	Calast
BCS23OE01	CSE(AI&ML)	AI for Financial Modelling	Select any one
BET23OE03	E&TC	Biology for Engineers	ally one
BIT23OE02	IT	Cyber Security: Understanding Cyber	31
		Crimes and Legal Perspectives	= 1
BME23OE04	Mechanical	Industry 4.0	0
BME23OE05	Mechanical	Energy storage management	

## List of courses – Entrepreneurship/ Economics/ Management Course (EEM)

Course Code	Course Type	Course Name						
BSH23EM01	EEM 1	Business Studies for Engineers						

#### **List of courses – Value Educational Course (VEC)**

Course Code	Course Type	Course Name
BSH23VE01	VEC 1	Universal Human Values

#### **CURRICULUM STRUCTURE**

#### Second Year B. Tech. (Civil Engineering) (Regulation 2023) Semester-IV (With effect from Academic Year 2025-26)

Course Code	Code				edit eme			Sch (Ho	chin em ours eek)	e	F	Evaluation Scheme and Marks					rks
	Course Type		L	P	Т	Total	L	P	Т	O	F	A	SA	TW	PR	OR	Total
											FA1	FA2					
BCI24PC07	PCC	Soil Mechanics	2			2	2	V		D	10	10	30				50
BCI24PC08	PCC	Soil Mechanics Lab		1		1		2						50		25	75
BCI24PC09	PCC	Concrete Technology	2			2	2		7	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			0	10	10	30				50
BCI24VS03	VSEC 3	Techniques and Testing Lab in Civil Engineering		2		2	Br	4 in	gs	Fr				75		25	100
BSH24EM 03	*AEC 2	Professional Development Training		2		2	edi	4		Cor				100			100
-	EEM 2	EEM 2	2			2	2		2	911	10	10	30				50
BSH24VE02	VEC 2	Constitution of India	2			2	2		22		25	25					50
	Tot	tal	14	6		20	14	12		3	85	85	180	275		75	700

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

<sup>\*</sup> Practical will be held division wise and not batch wise

<sup>\$</sup> Refer separate booklet for Exit Policy courses of Civil Engineering Program

L- Lecture, T- Tutorial, P- Practical, H-Hours, CR- Credit, FA – Formative Assessment, SA – Summative Assessment, TW – Term Work, PR- Practical Exam, OR – Oral Exam

#### Semester – IV

#### **List of Open Elective courses – Engineering Science**

<b>Course Code</b>	Offered by	Course Name				
BSH24OE04	AS&H	Statistical Data Analysis using R				
BSH24OE05	AS&H	Advanced Materials & Characterizations				
BCS24OE02	CSE(AI&ML)	SE(AI&ML) Data Science				
BET24OE01	E&TC	Electrical Machines	Select Any one			
BET24OE02	E&TC	Introduction to Signals and Systems				
BIT24OE01	IT	Operating System's Administration	, , , , ,			
BME24OE01	Mechanical	Material Science				
BME24OE03 Mechanical		Fundamentals of Mechanical Components and				
21.122.0200	1.20011041	Systems				

## List of courses – Entrepreneurship/ Economics/ Management Course (EEM)

<b>Course Code</b>	e Code Course Type Course Title					
BSH24EM02	EEM 2	Designing Thinking & Innovation Management				
BSH24EM03	EEM 2	Project Management	Select Any			
BSH24EM04	EEM 2	Fostering Entrepreneurship and Startups	one			
BSH24EM05	EEM 2	Business finance for engineers	3			

#### **List of courses – Value Educational Course (VEC)**

Course Code	Course Type	Course Name
BSH24VE02	nowleVEC2 Brin	Constitution of India

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## Course Syllabus SYB Tech Semester-III

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Program:	B. Tech. (C	Civil Enginee	ering)			Sen	nester :	III			
Course:	<b>Building Planning and Construction</b>						Code:	BCI23PC02			
	Tes	Evaluation Scheme and Marks									
~	Lastura	Practical	Tutorial	Other	F	FA		<b>A</b>	Total		
Credits	Lecture	Practical	1 utoriai	Other	FA1	FA2	S	A	Total		
2	2			1	10	10	3	0	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.

#### Detailed Syllabus

Unit	Description	Duration (H)
1	<b>Building Planning:</b> 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	<b>Building Construction:</b> 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)

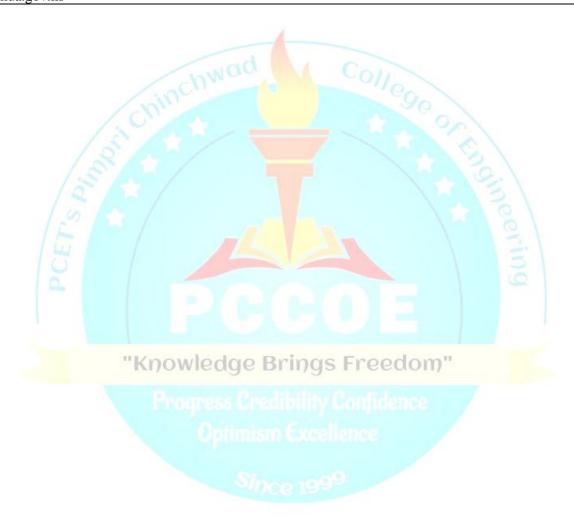
8. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill.5th Edition (2017)

#### **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:	<b>Building Plann</b>	Code: BCI23PC03					
	Teachi	Evaluation Scheme and Marks					
Credits	Lecture	Practical	Tutorial	TW OR		PR	Total
1		2		50 25			

#### **Prior Knowledge:**

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

Program:	B. Tech. (Civil Engineering)				Semester : III				
Course:	Fluid Mechanics				Code: BC123PC04			PC04	
	Tes	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
G 34	Lastura	Practical	Tutorial	T			S	A	Total
Credits	Lecture	Practical	1 utoriai	Other	FA1	FA2			Total
2	2	-	-	1	10	10	3	0	50

#### **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  $\Pi$  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 S <mark>ylla</mark> bus	
Unit	Description	Duration (H)
	<b>Properties of Fluids:</b> 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.	
1	<b>Dimensional Analysis and Model studies:</b> Dimensions of physical quantities, Dimensional homogeneity, dimensional analysis using Buckingham's $\pi$ theorem method, geometric, kinematic and dynamic similarity, important dimensionless numbers and their significance. Model laws, scale effect, distorted and undistorted models.	07
2	<b>Fluid Statics:</b> 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.	07
	<b>Buoyancy and Floatation:</b> Principle of floatation and buoyancy, stability of floating and submerged bodies.	
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.	08
3	<b>Fluid flow around submerged objects:</b> 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.	

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<sup>st</sup> Edition, Standard book house publication, 2017.
- 2. Flow in Open Channels by K Subramanya, 5<sup>th</sup> 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		III							
Course:	Fluid Mechanic	Fluid Mechanics Lab				Code: BCI23PC05				
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total			
1	-	02	-	50	-	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:

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

Program:	B. Tech. (Civil Engineering)				Semester : III				
Course:	Strength of	Strength of Materials				Code: BC123PC			PC06
	Tea	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
~	Lastura	Practical	Tutorial	Other	F	4	S	A	Total
Credits	Lecture	Practical	1 utoriai	Other	FA1	FA2			1 Otal
02	02	-	-	1	10	10	3	0	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 of resistance 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<sup>rd</sup>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. 5<sup>th</sup> 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. 7<sup>th</sup> Edition, 2017
- 4. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication. 2<sup>nd</sup> Edition, 2011
- 5. Mechanics of Materials by Gere & Timoshenko, CBC publisher. 8<sup>th</sup> 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

https://nptel.ac.in/courses/105/105/105105108/ https://nptel.ac.in/courses/112/107/112107146/



# Open ElectiveMathematics SYB Tech Semester-III

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Program:	B. Tech. (Civil	B. Tech. (Civil Engineering)				nester :	III	
Course:	Applied Mathematics (OE-Mathematics Suggested for Civil branch from AS&H)					Code:	BSH23	OE03
	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
a	Lecture	Practical	Tutorial	FA		S	A	Total
Credits	Lecture	Pracucai	1 utoriai	FA1 FA2				Total
02	02	-	-	10	10	3	0	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 for measures of variability of numerical data, Curve fitting, Correlation and Regression.
- 2. **Make predictions** for the numerical data using probability theory and hypothesis testing.
- 3. **Compute** approximate solution for interpolation, integration and ordinary differential equations Using numerical methods.
- 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
- 3. Edition, ISBN 13: 9781842658468
- 4. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, 42 Edition, ISBN 13: .9788174091955
- 5. N. P. Bali, Manish Goyal, "A textbook of Engineering Mathematics", 9th Edition, ISBN 16:978-8131808320

#### e-sources:

1. NPTEL Course lectures links:

https://nptel.ac.in/courses/111/105/111105090/ (Probability)

https://onlinecourses.nptel.ac.in/noc20 ma13/ (Advanced Engineering Mathematics)

2. V-lab (IIT-Bombay) link: <a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical\_lab/labs/explist.php">http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical\_lab/labs/explist.php</a>



Program:	B. Tech. (Civil Engineering)				Semester : III					
Course:	Computational Techniques (OE-Mathematics Suggested for E&Tc branch)				Code: BSH23OE02			OE02		
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks						
G 11	Lecture	Practical	Tutorial	FA		FA		S	A	Total
Credits	Lecture	r ractical	า นเอกสา	FA1	FA2			Total		
02	02	-	-	10	10	3	0	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** statistical methods like variability, curve fitting, correlation and regression analysis for prediction of a given data.
- 2. **Analyze** the data using probability theory and distributions.
- 3. **Make predictions** for the numerical data using hypothesis testing.
- 4. **Compute** approximate solution for interpolation, integration and ordinary differential equations using numerical methods.

#### **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.

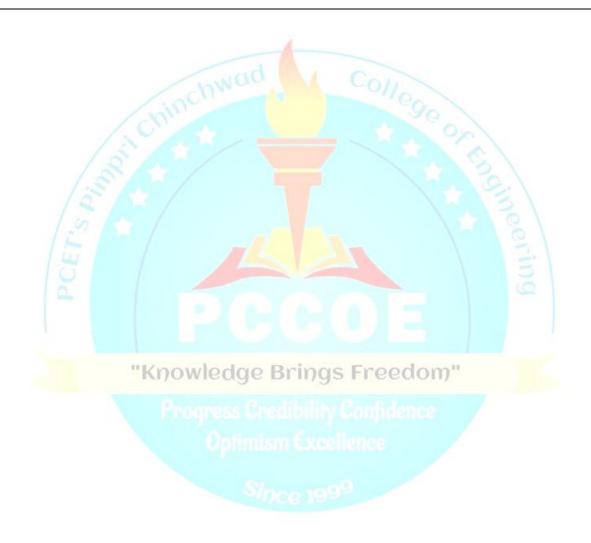
#### **Reference Books:**

- 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:**

<u>Probability Theory for Data Science - Course (nptel.ac.in)</u> (Statistics, Probability and Hypothesis testing) Numerical methods - Course (nptel.ac.in) (Numerical Methods)



Program:	B. Tech. (Civil Engineering)				Semester : III			
Course:	Applied Mathematics (OE-Mathematics Suggested for Mech branch)				Code: BSH23OE01			OE01
	Teaching Scheme (Hrs./Week)				<b>Evaluation Scheme and Marks</b>			
G 11	Lecture	Practical	Tutorial	FA		S	A	Total
Credits	Lecture	rracucai	i utoriai	FA1	FA2			Total
02	02	-	-	10	10	3	0	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 for measures of variability of numerical data, Curve fitting, Correlation and Regression.
- 2. **Make predictions** for the numerical data using probability theory and hypothesis testing.
- 3. **Apply** variable separation method to solve wave, transport, one and two-dimensional heat flow equations.
- 4. **Solve** the mass spring system and similar problems using Laplace and Inverse Laplace Transform.

#### **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	<b>Applications of Partial Differential Equations:</b> Solution to One dimensional Wave, Heat and Transport equation, Two-dimensional heat flow equation using Method of separation of variables.	7
4	<b>Laplace Transform:</b> 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:**

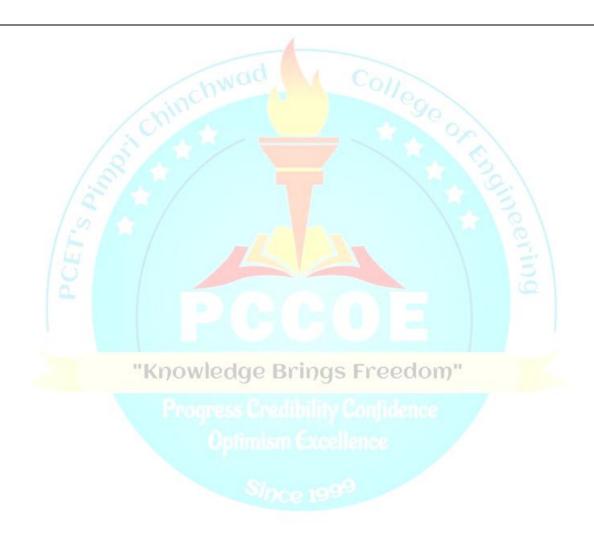
- 1. Erwin Kreyszig, "Advanced Engineering Mathematics" Wiley Eastern Ltd.,10 Edition, ISBN 13: 9780470458365
- 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, 42 Edition, ISBN 13:9788174091955.
- 3. N. P. Bali, Manish Goyal, "A textbook of Engineering Mathematics", 9th Edition, 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:**

https://nptel.ac.in/courses/111/105/111105038/ (P.D.E)

https://onlinecourses.nptel.ac.in/noc20\_ma13/ (Advanced Engineering Mathematics)



Program:	B. Tech. (Civil Engineering)				Sen	nester :	III/IV			
Course:	Computational Techniques (OE Maths Suggested for Comp/Comp R/IT branch)					Code:	BSH23 BSH24			
	Teaching Scheme (Hrs./Week)				Evalua	tion Sch	eme and	Marks		
a	Lecture	Practical	Tutorial	FA		FA S		SA		Total
Credits	Lecture	Fractical	1 utoriai	FA1	FA2			Total		
02	02	-	-	10	10	3	0	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** statistical methods like variability, curve fitting, correlation and regression analysis for prediction of a given data.
- 2. **Analyze** the data using probability theory and distributions.
- 3. **Make predictions** for the numerical data using hypothesis testing.
- 4. Solve transportation and assignment problems using optimization techniques.

#### **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	<b>Transportation Problems:</b> 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. <b>Assignment Problems:</b> 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.

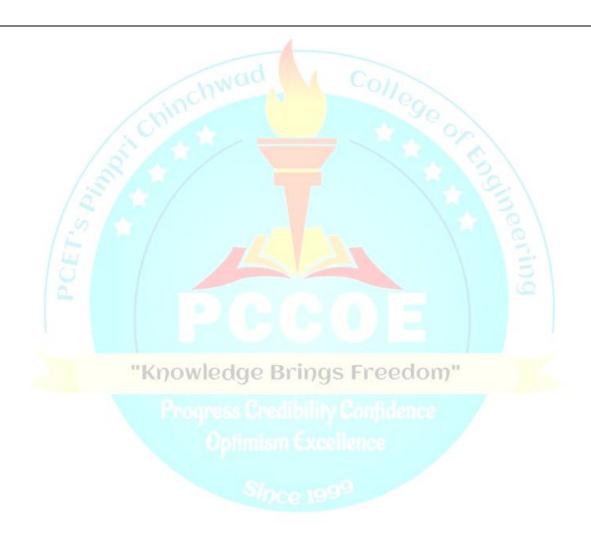
#### **Reference Books:**

- 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:**

<u>Probability Theory for Data Science - Course (nptel.ac.in)</u> (Statistics, Probability and Hypothesis testing) <a href="https://nptel.ac.in/courses/110/106/110106059/">https://nptel.ac.in/courses/110/106/110106059/</a> (Transportation&AssignmentsProblems)



Program:	B. Tech. (Civil Engineering)				Semester : III/IV			
Course:	Mathematical Optimization					Code:	BSH23	OE08/
	(OE Maths Suggested for CSE-AI&ML)						BSH24	OE08
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks				Marks
G 11	Lecture	Practical	Tutorial	FA		S	A	Total
Credits	Lecture	Fractical	Tutoriai	FA1	FA2			Total
02	02	-	-	10	10	3	0	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. **Formulate** and solve linear programming models using graphical, Simplex method.
- 2. **Solve** transportation and assignment problems using optimization techniques.
- 3. Analyze the project network problems and their solutions using critical path method to optimize models.
- 4. **Apply** variants of numerical methods to find optimal solutions for constrained, unconstrained problems.

#### **Detailed Syllabus**

Unit	Description	Duration (H)
1	<b>Linear Programming (LP):</b> 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	<b>Network Analysis:</b> 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:**

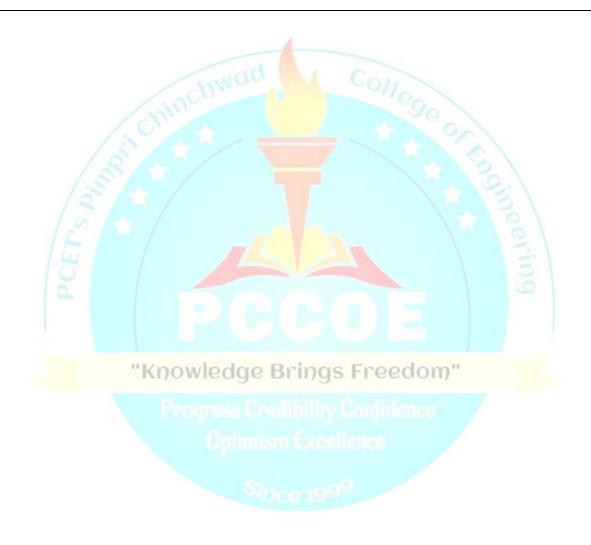
- 1. Sharma S.D.Operation Research, Kedarnath Ramnath & Co.Edition, ISBN: 9380803389
- 2. Peter. O'Neil, "Advanced Engineering Mathematics," Thomson Learning,7 Edition, ISBN 13: 9781337274524
- 3. Hira Gupta, "Operation Research," S.Chand Publication, ISBN(13): 9788121909686.
- 4. Sharma J.K."Operations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

#### e-sources:

#### **NPTEL Course lectures links:**

https://nptel.ac.in/courses/111/102/111102012/(LPP)

https://nptel.ac.in/courses/110/106/110106059/(Transportation&AssignmentsProblems)



## Open Elective-Department Specific SY B Tech Semester-III

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Program:	B. Tech. (Civil Engineering)				Sen	nester :	III	
Course:	Neural Network and Fuzzy Logic Control					Code:	BSH23	OE06
	(OE-Departme							
	Teaching Scheme (Hrs./Week)			<b>Evaluation Scheme and Marks</b>				Marks
~			FA		SA		Total	
Credits	Lecture Practical	Tutorial	FA1	FA2			Total	
02	02	-	-	10	10	3	0	50

Prior Knowledge: Nil

#### **Course Objectives:**

This course aims to enable students to get acquainted with,

- 1. Knowledge of Neural Networks and its use for controlling real-time systems.
- Knowledge about fuzzy set theory to solve various engineering problems.

#### **Course Outcomes:**

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

- 1. Compute feedforward Artificial Neural Network output using basic concepts related to Artificial Neural Network.
- 2. Apply backpropagation and optimizer algorithms to update weights of Neural Networks and application-based problem-solving.
- 3. Find fuzzification and defuzzification of crisp function using basic Fuzzy set theory concepts.
- 4. **Apply** a fuzzy logic control system to handle uncertainty and some engineering problems.

Unit	Description	Duration (H)
I	Architecture of Neural Network: Introduction, Biological Neural Network, Artificial Neural Network, The architecture of Artificial Neural Networks- Bias, Activation Function, Learning Methods, Learning rules, Types of Neural Networks: Single-layer, multi-layer, feed-forward, and recurrent neural networks.	7
II	<b>Neural Networks For Control:</b> Loss function, Weight initialization, Optimizers algorithms, Backpropagation Algorithm, Associative Memory Networks and their types, Discrete-time hop field networks.	8
III	<b>Fundamental of Fuzzy Logic:</b> Fundamental of Fuzzy Logic: Classical sets, Fuzzy Sets, Membership function, Cardinality of fuzzy set, Fuzzy complement, Fuzzy Composition, properties and operation on Fuzzy sets, Fuzzy Relation, Fuzzification, Defuzzification.	7
IV	<b>Fuzzy Logic Control:</b> Fuzzy Rule, Decision-making Logic, Linguistic variables Fuzzy Inference System: Mamdani FIS, Sugeno FIS Design of fuzzy controller, fuzzy optimization, applications of FIS to some real-life problem.	8
	Total	30

- 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.
- Zimmerman H.J., "Fuzzy set theory and its Applications," Kluwer Academic Publishers Dordrecht, 2001. Driankov, Hellendroonb, "Introduction to fuzzy control," Narosa Publishers, 2001.
- G Klir, B Yuan, "Fuzzy sets and fuzzy logic: Theory and application," PHI, ISBN:
- LauranceFausett, Englewood Cliffs, N.J., "Fundamentals of Neural Networks," PearsonEducation, New Delhi, 2008.
- B Yegnanarayana: Artificial Neural Networks for pattern recognition, PHI Learning Pvt. Ltd., 14-Jan-2009

#### e-sources:

Online course "Fuzzy Logic and Neural Network" by Prof. Dilip Kumar Pratihar,

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:	BCE230	OE01
	Teaching Scheme (Hrs./Week)				Evalua	tion Sch	eme and	Marks
~	Lecture	Practical	Tutorial	FA1 FA2		SA		Total
Credits	Lecture	Fractical	1 utoriai					Total
02	02	-	-	10	10	3	0	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.

	Detaile <mark>d Syllabus</mark>	
Unit	Description	Duration (H)
I	Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database System Structure.	6
II	Data Models, Database Design, Entity Relationship Model, ER Diagram, Extended ER diagram, converting E-R and Extended ER diagram into tables.	8
III	Relational Model: Basic concepts, CODD's Rules, Relational Integrity: Domain, Referential Integrities Database Design: Features of Good Relational Designs, Normalization, Atomic Domains, and First Normal Form, 2NF, 3NF, BCNF.	8
IV	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: http://w3schools.org/

Program:	B. Tech. (Civil Engineering)				Semester: III			
Course:	Principles of Software Engineering				Code: BCE23OE02			OE02
	(OE-Department Specific offered by Computer)							
	Teaching Scheme (Hrs./Week)			]	Evaluati	ion Sche	me and	Marks
G 11	Lecture	Practical	Tutorial	F	A	S	A	Total
Credits	Lecture	Fractical	า นเอกสา	FA1 FA2				1 Otal
02	02	-	-	10	10	3	0	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.

Unit	Description	Duration (H)
I	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
II	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
III	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
IV	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: http://w3schools.org/

Program:	B. Tech. (Civil Engineering)				Semester: III		III	
Course:	Android App Development with Kotlin (OE-Department Specific offered by Computer)					Code:	BCE23	SOE03
	Teaching Scheme (Hrs./Week)			]	Evaluati	ion Sche	me and	Marks
- ·	Lecture	Practical	Tutorial	F	A	S	A	Total
Credits	Lecture	Fractical	1 utoriai	FA1	FA2			Total
02	02	-	-	10	10	3	0	50

llege or

**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.

Unit	Description	Duration (H)
I	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
II	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
III	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
IV	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 Financia (OE-Departme	al Modelling nt Specific offero	ed by CSE)			Code:	BCS23	OE01
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial	F	FA		A	Total
Credits	Lecture	Practical	1 utoriai	FA1	FA2			1 Otal
02	02	-	-	10	10	3	0	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

	Detaile <mark>d Syllabus</mark>	
Unit	<b>Description</b>	Duration (H)
I	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
II	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
III	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
IV	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:** https://www.udemy.com/course/python-and-machine-learning-in-financial-analysis/https://www.udemy.com/course/ai-for-finance/

Program:	B. Tech. (Civil Engineering)			Semester: III				
Course:	Biology for Engineers (OE-Engineering Science offered by E&TC)			Code: BET23OE03			OE03	
	Teaching Scheme (Hrs./Week)				Evalua	ation Sch	eme and	Marks
G 114	Lecture	Practical	Tutorial	F	4	S	<b>A</b>	Total
Credits	Lecture	Fractical	Tutoriai	FA1	FA2	3.	A	Total
02	02			10	10	3	0	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 repolarization. Introduction to few important bio-potential such as Electrocardiogram(ECG), Electroencephalogram(EEG) and Electromygram (EMG).	08
	Total	30

#### **Text Books:**

- 1.Dr. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", Vayu Education Of India, New Delhi, 2014.
- Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, 2<sup>nd</sup> 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<sup>th</sup> edition Wiley publication
- 6. Joseph H. Carr, John M. Brown, Introduction to Biomedical equipment Technology, 4edition, Pearson publication

Program:	B. Tech. (Civil Engineering)				Semester : III		III	
Course:	Cyber Security: Understanding Cyber			Code: BIT23OE02		OE02		
	Crimes and Legal Perspectives							
	(OE-Department Specific offered by IT)							
	Teaching Scheme (Hrs./Week)				Evaluati	ion Sche	me and	Marks
Q 11.	Lecture	Practical	Tutorial	F	A	S	A	Total
Credits	Lecture	Fractical	1 utoriai	FA1	FA2			Total
02	02	-	-	10	10	3	60	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. <a href="https://www.udemy.com/course/certified-secure-netizen/">https://www.udemy.com/course/certified-secure-netizen/</a>
- 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:	BME2	3OE04
	Teaching Scheme (Hrs./Week)				Evaluati	ion Sche	me and	Marks
G 11.	Lecture	Dragtical	Tutomial	F.	FA		A	Total
Credits	Lecture	Practical Tutorial		FA1	FA2			Total
02	02	-	-	10	10	3	0	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)
I	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
II	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
III	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
IV	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:

https://nptel.ac.in/courses/108105063

Program:	B. Tech. (Civil	Engineering)	Semester : III								
Course:	Energy Storage (OE-Departme	Code: BME23OE05			3OE05						
	Teachi	Teaching Scheme (Hrs./Week)					Evaluation Scheme and Marks				
	Lastres	Dungting	Tutorial	FA		S	A	Total			
Credits	Lecture	Practical	Tutorial	FA1 FA2				Total			
02	02	-	-	10	10	3	0	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

Unit	Description	Duration (H)
Ι	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
II	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
III	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
IV	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 Scient and Technology, Second Edition, Springer reference.
- 5. Handbook of Energy Audit by Sonal Desai Publisher Tata McGraw Hill.



# Entrepreneurship/ Economics/ Management Course (EEM)

SY B Tech Semester-III

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Program:	B. Tech. (Civil	Semester : III						
Course:	<b>Business Studio</b>	Code:			BSH23	BSH23EM01		
	(Offered by AS	&H)						
	Teachir	Evaluation Scheme and Marks						
	Lastrons	Dwastiaal	Tutowiol	FA		S	A	Total
Credits	Lecture	Practical	Tutorial	FA1 FA2				Total
02	02	-	-	10	10	3	0	50

#### Prior knowledge of: NA

#### **Course Objectives:**

This course aims at enabling students:

- 1. To help the students to gain understanding of various perspectives in the field of Strategic Management
- 2. To enable the students to pursue the modern management practices in business.
- 3. To provide the students an understanding about tools and techniques of economic principles in business management.

#### **Course Outcomes:**

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

- 1. **Explain** the concept of Management and Strategic Management with their implications.
- 2. **Illustrate** the Management Trends and Practices implied in Global Work Culture.
- 3. **Apply** the economic variables in general business atmosphere.
- 4. **Analyze** the business expansion strategies abroad and key issues related to their operations.

	Detaile <mark>d Syllabus</mark>	
Unit	<b>Description</b>	Duration (H)
1	Introduction to Management & Strategic Management: Journey towards Goals  Concepts of Management, Definition of Management, Functions of Management, Levels of Management, Concept of Strategic Management, Strategic Management Process-Vision, Mission, Goals, Objectives, Hierarchy of Objectives, Situational Analysis / Internal and External Analysis Organizational Goals, Planning Through MBO- Practical Insights, Michael Porter 5 Forces Analysis, Balanced Score Card (BSC), BSC v/s MBO. Case Studies: Starbucks Corporation, TATA Steel	7
2	Management Trends and Practices - Let Us Explore  Comparative Management Styles and Approaches, Japanese Management Practices, Organizational Creativity and Innovation, Management of Innovation, Entrepreneurial Management, Benchmarking, Best Management Practices across the world, Management of Diversity, Selected cases of Domestic & International Corporations.	8
3	Business Economics – The Road Map  Concept and Definition of Micro Economics and Macro Economics, Nature & Scope of Micro Economics and Macro Economics, Demand, Supply and Market equilibrium: Individual demand, Market demand, Individual supply, Market supply, Market equilibrium; Elasticity is of demand and supply; Price elasticity of demand, Income elasticity of demand, Cross price elasticity of demand, Elasticity of supply, Business cycle, Demographic Profile of Indian Population and Market, Urbanization.	7
4	International Business –Let Us Go Global  Basic concept of International Business, Decision framework, Analyzing marketing opportunities – collection and analysis of marketing information, Modes of entering overseas markets, International Marketing process and techniques – direct exporting, Indirect exporting, counter trade, Licensing, Sub- contracting, Joint – ventures, Organization and control of international marketing operations, International tendering, Procurement for export; Export information system, Global Business Environment, Innovation and International management, managing multinational market, Research Methods in International Business (RMIB).	8
	Total	30

#### Department of Civil Engineering

#### **Text Books:**

- 1. George R. Terry, Stephen G. Franklin; Principles of Management, A.I.T.B.S. Publishers
- 2. Wendrila Biswas, Debarun Chakraborty, and Soumya Kanti Dhara.;"Recent Trends in Management"
- 3. Nyagucha Oresi Samwel; Micro and Macro Economics; Understanding the Basics of Economics (English, Paperback)
- 4. Dr.P.Subba Rao, International Business (Text and Cases)

#### **Reference Books:**

- 1. Dinesh Madan, Strategic Management A Complete Reference, Aldine CA
- 2. Nadar .E.Narayanan Vijayan S., Managerial Economics, PHI learning
- 3. Charles W. L. Hill, International Business, Mc, Graw Hill.

**e-sources:** https://openstax.org/books/principles-management/pages/references



## Value Education Course (VEC)

### SY B Tech Semester-III

"Knowledge Brings Freedom"

Progress Credibility Confidence
Optimism Excellence

Since 1999

Program:	B. Tech. (All B	Semester : III						
Course:	Universal Hum	an Values(Offer	ed by AS&H)	Code: BSH23VE01				VE01
	Teachir	Evaluation Scheme and Marks						
	Lastura	Practical	Tutorial	FA		S	<b>A</b>	Total
Credits	Lecture	Practical	Tutoriai	FA1	FA2	3.	A	Total
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. **Explain** the relevance of 'Universal Human Values'
- 2. **Develop** an understanding about human being as co-existence of 'Self' & 'Body'
- 3. **Apply** the sense of harmony in family and society
- 4. **Take part** in ensuring coexistence with nature by integrating Universal Human Values into personal and professional lives.

	Detailed Syllabus	
Unit	Description	Duration (H)
I	Introduction to Value Education:	4
	Exploring Human Consciousness     Exploring Natural Acceptance doe Brings Freedom  Experiential Learning     Seva Activity	3
	<ul> <li>Harmony in the Human Being:</li> <li>Human being as the Co-existence of the Self and the Body</li> <li>Needs of the Self and the Body</li> <li>The Body as an Instrument of the Self</li> <li>Understanding Harmony in the Self</li> <li>Harmony of the Self with the Body</li> <li>Programme to ensure self-regulation and Health</li> </ul>	4
II	Practice Session:  • Exploring the difference of Needs of Self and Body  • Exploring Sources of Imagination in the Self  • Exploring Harmony of Self with the Body  Experiential Learning  • Seva Activity  • Health Awareness Programme.	4
III	Harmony in the Family and in Society;  • Harmony in the Family • Trust'—the Foundational Value in Relationship • Respect' – as the Right Evaluation	4

		1					
	Other feelings (Values) in Human-to-Human Relationship						
	Understanding Harmony in Society						
	Vision for the Universal Human Order						
	Five Dimensions of Human Order						
	Practice Session:						
	Exploring the Feeling of Trust						
	<ul> <li>Exploring the Feeling of Respect and Exploring Systems to</li> </ul>	3					
	Fulfil Human Goal	3					
	Experiential Learning						
	Seva Activity						
	Harmony in Nature/Existence:						
	Understanding Harmony in Nature,						
	Realising 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	4					
	A Basis for Humanistic Education						
	Humanistic Constitution and Universal Human Order,						
	Competence in Professional Ethics						
	<ul> <li>Holistic Technologies, Production Systems and Management Models-Typical Case</li> </ul>						
IV	Studies						
- 1	Strategies for Transition towards Value-based Life and Profession.						
	Practice Session:						
	Exploring the Four Orders of Nature	,					
	Exploring Co-existence in Existenc	\					
	Exploring Ethical Human Conduct	\					
	Exploring Humanistic Models in Education  Exploring State of Transition to a second Main and Main	4					
	• Exploring Steps of Transition towards Universal Human Order	. \					
	Experiential Learning Activity     Health Awareness Programme/Waste Management Programme	2 \					
	Health Awareness Programme/ waste Management Programme     (Hospital Waste/Pharmaceutical Industrial Waste/Reduce)	2					
	Plastic Waste / E-Waste Management)						
		20					
	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: EkParichaya, 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

Program:	B. Tech. (Civi	il Engineering	<u>;</u> )	Semester:	III		
Course:	<b>Community I</b>	Engagement P	Code:	BCI23EL01			
	Teaching S	Scheme (Hrs./	Week)		Evalua	tion Scheme a	nd Marks
Practical Tutorial Credit Hours				TW	OR	PR	Total
4	-	2	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 realties 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 O Wledge Brings Freedom"
- 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 Biologyl, 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

https://onlinecourses.nptel.ac.in/noc23\_hs155/preview

# Course Syllabus SYB Tech Semester-IV

"Knowledge Brings Freedom"

Optimism Excellence

Since 1999

Program:	B. Tech. (Ci	B. Tech. (Civil Engineering)					Semester: IV				
Course:	Soil Mechai	Soil Mechanics					Code: BCI24PC07				
	Т	Teaching Scheme (Hrs/Week)					Evaluation Scheme and Marks				
G 14	Lecture	Practical	Tutorial	Other	FA1 FA2		S	<b>A</b>	Total		
Credits	Lecture	Fractical	Tutoriai	Other			3.	A	Total		
02	02			1	10	10 10		0	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	<b>Description</b>	<b>Duration</b> (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 Rehbanns and Culmanns 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.

#### Department of Civil Engineering

#### **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				
	Teachi	ng Scheme (Hrs/	Week)	Evaluation Scheme and Marks				
Credits	Lecture	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. Rehbann'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, 5<sup>th</sup> Edition, 2017.
- 2. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8<sup>th</sup> 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, 2<sup>nd</sup> Edition, 2017.
- 5. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3<sup>rd</sup> 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-engineersportable-handbook-second edition.
- **3.** http://nptel.ac.in/courses/105101084/
- **4.** http://nptel.ac.in/courses/105106142/

Program:	B. Tech. (Ci	Semester: IV							
Course:	Concrete Te	Code: BCI24PC09				PC09			
	T	Evaluation Scheme and Marks							
a	Tastuna	Due etical	Tutorial	Othor	FA	4			
Credits	Lecture	Practical	Tutoriai	Other	FA1 FA2		S	A	Total
02	02			1	10	10	3	0	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	<b>Duration</b> (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:**

IS 383:2016- Coarse and Fine Aggregate for Concrete Specification

IS 456:2000 with Reaffirmed 2016-Plain and Reinforced concrete- code of practice

IS 516: 1959 with Reaffirmed 2018- Methods of tests for strength of concrete

IS 1489 (Part 1): 2015(4 Revision)- Portland pozzolana cement - Specification: Part 1 fly Ash Based

IS 2386 (Part 1 to 5):1963 with Reaffirmed 2021 -Methods of Test for Aggregates for Concrete

IS 4031 (Part 1,10 to 13):1996 with Reaffirmed 2021 -Methods of physical tests for hydraulic cement

IS 9103: 1999 (1 Revision) with Reaffirmed 2018- Specification for Concrete Admixtures

IS 1199: Part 1 to 5: 2018 - Fresh Concrete Methods of Sampling, Testing and Analysis

IS 10262 : 2019 (2 Revision)- Concrete Mix Proportioning Guidelines

IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 1Ultrasonic Pulse Velocity

IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 2 Rebound Hammer

#### E-resource:

https://www.concrete.org/

https://archive.nptel.ac.in/courses/105/102/105102012/



Program:	B. Tech. (Civil E		Semester: IV				
Course:	Concrete Techno	ology Lab		Code:	BCI24PC10		
	Teaching Scheme (Hrs/Week) Evaluation Sch				eme and Mar	ks	
Credits	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.
- 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:

IS 383:2016- Coarse and Fine Aggregate for Concrete Specification

IS 456:2000 with Reaffirmed 2016-Plain and Reinforced concrete- code of practice

IS 516: 1959 with Reaffirmed 2018- Methods of tests for strength of concrete

IS 1489 (Part 1): 2015(4 Revision)- Portland pozzolana cement - Specification: Part 1 fly Ash Based

IS 2386 (Part 1 to 5):1963 with Reaffirmed 2021 -Methods of Test for Aggregates for Concrete

 $IS\ 4031\ (Part\ 1,10\ to\ 13): 1996\ with\ Reaffirmed\ 2021\ - Methods\ of\ physical\ tests\ for\ hydraulic\ cement$ 

IS 9103: 1999 (1 Revision) with Reaffirmed 2018- Specification for Concrete Admixtures

IS 1199: Part 1 to 5: 2018 - Fresh Concrete Methods of Sampling, Testing and Analysis

IS 10262: 2019 (2 Revision)- Concrete Mix Proportioning Guidelines

IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 1Ultrasonic Pulse Velocity

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)					Sei	mester : IV				
Course:	Structural A	Structural Analysis I					Code:	BCI24P	PC11		
	To	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks					
G 114	Lecture	Practical	Tutorial	Other	FA		FA		S	<u> </u>	Total
Credits	Lecture	Fractical	Tutoriai	Other	FA1	FA2	3.	A	Total		
02	02			1	10	10	3	0	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. Analyze beams and frames by slope deflection method.
- 3. Analyze beams and frames by moment distribution method.
- 4. Analyze 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	<ul> <li>Slope-Deflection Method:</li> <li>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.</li> <li>b) Sway analysis of rigid joint rectangular single bay single storey portal frames using Slope deflection method. (Involving not more than three unknowns)</li> </ul>	7
3	<ul> <li>Moment Distribution Method:</li> <li>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.</li> <li>b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using Moment distribution method (Involving not more than three unknowns).</li> </ul>	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<sup>th</sup> Edition, 2014
- 3. Structural Analysis: A Matrix Approach by G.S.Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Limited, 2<sup>nd</sup> Edition, 2016

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#### **Reference Books:**

- 1. Intermediate Structural Analysis by C. K. Wang, Tata McGraw Hill Education Pvt. Ltd. 7<sup>th</sup> 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, 23<sup>rd</sup> 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. 3<sup>rd</sup> Edition, 2013
- 5. The Plastic Methods of Structural Analysis by B. G. Neal, Champman & 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:

https://nptel.ac.in/courses/105/101/105101086/ https://nptel.ac.in/courses/105/106/105106050/



### Open Elective-Engineering Science SY B Tech Semester-IV

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Program:	B. Tech. (Civil Engineering)				Sei	Semester: IV			
Course:	Statistical Data Analysis Using R (OE-Engineering Science offered by AS&H)					Code:	BSH240	DE04	
	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks				
G 11.	Lastura	Practical	Tutorial	FA		S	<b>A</b>	Total	
Credits	Lecture Practical		Tutoriai	FA1	FA2	3.	A	Total	
02	02			10	10	3	0	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. **Understand** the data and differentR packages related to data science and its access.
- 2. Make use of data pre-processing methods and generate quality data for analysis.
- 3. Apply different data visualization techniques to understand the data.
- 4. **Analyse** the data for decision-making using statistical methods.

#### **Detailed Syllabus**

Unit	Description	Duration (H)
I	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
II	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
III	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
IV	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. <a href="https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB">https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB</a> (Probability)
- 2. <a href="https://nptel.ac.in/courses/111104100">https://nptel.ac.in/courses/111104100</a> (Introduction to R software)
- 3. <a href="https://www.youtube.com/watch?v=WbKiJe5OkUU&list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz">https://www.youtube.com/watch?v=WbKiJe5OkUU&list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz</a> (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:	BSH240	OE05
	Teaching Scheme (Hrs/Week)				Evalua	ation Sch	eme and	Marks
G 114	Lecture	Practical	Tutorial	F	4	S	<b>A</b>	Total
Credits	Lecture	Fractical	Tutoriai	FA1	FA2	3.	A	Total
2	2	-	2	10	10	3	0	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

	Detaile <mark>d Syllabus</mark>	
Unit	<b>Description</b>	<b>Duration</b> (H)
I	<b>Engineering Materials:</b> 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
II	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
Ш	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
IV	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. Kittle, 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.

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- 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			Code: BCS24OE02			DE02	
	(OE-Engineering Science offered by CSE)							
	Teaching Scheme (Hrs./Week)			<b>Evaluation Scheme and Marks</b>				
a	<b>T</b> .	I actions Durantical	Tukowiol	FA		C		Total
Credits	Lecture Practical		Tutorial	FA1	FA2	S	A	Total
02	02			10	10	3	0	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)
I	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
п	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
Ш	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 logodds, 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
IV	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. 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-Department Specific offered by E&TC)					Code:	ВЕТ24	OE01
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks				
			F.	A	S	A	Total	
Credits	Lecture	Practical	Tutorial	FA1	FA2			Total
02	02	-	-	10	10	3	60	50

**Prior Knowledge:** of electromagnetism & electrical parameters

#### **Course Objectives:**

- To impart basic knowledge for conceptual understanding of DC machines.
- To explore the construction and performance characteristics of three phase AC machines.
- To explore the construction and performance characteristics of single-phase AC machines.
- 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
- Relate the applications of electrical machines to their respective fields of study and industrial applications.

Unit	Description	Duration (H)	
I	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.		
II	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	
III	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	
IV	<b>Special Purpose Motors:</b> 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:**

- V. N. Mittal and Arvind Mittal, "Basic Electrical Engineering", 2nd Edition. (McGraw-Hill),2010 D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010 1.

#### **Reference Books:**

- J.B. Gupta, "Theory and Performance of Electrical Machines," S.K. Kataria & Sons. 1.
- 2. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electric Machinery," McGraw-Hill Education.
- D. C. Kulshreshtha, "Basic Electrical Engineering", 1st Edition (Tata McGraw hill),2009 3.
- B. L. Theraja and A. K. Theraja S. Chand & Co. Pvt. Ltd. New Delhi, "A textbook of Electrical Technology Vol 4. II",2020

#### e-sources:

- 1. Electrical Machines I-https://onlinecourses.nptel.ac.in/noc20\_ee60/preview
- Electrical Machines I-https://archive.nptel.ac.in/courses/108/105/108105017/

Program:	B. Tech. (Civil Engineering)				Sen	nester :	IV	
Course:	Introduction to Signals and Systems (OE-Department Specific offered by E&TC)			Code: BCS24OE02			OE02	
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks				
	Lastura	Dugatical	Tutorial	F.	A	SA		Total
Credits	Lecture	Practical	Tutorial	FA1 FA2				Total
02	02	-	-	10	10	3	60	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	<b>Laplace Transform and Z Transform</b> : Definition of Laplace Transform (LT), ROC, Laplace transform of standard periodic and aperiodic functions, Inverse Laplace transform, Application of Laplace transforms.	8
ı	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 I, McGraw Hill, 2nd Edition, 2017

#### Reference Books:

- 1. B P Lathi —Linear Systems and Signalsl, Oxford University Press, Third Edition, 2017
- 2. Simon Haykins and Barry Van Veen —Signals and Systemsl, Wiley India, 2nd Edition. 2017
- 3. M.J. Roberts Signal and Systems I, Tata McGraw Hill, Third Edition, 2019.
- 4. Charles Phillips —Signals, Systems and Transformsl, 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:

https://onlinecourses.nptel.ac.in/noc23\_ee14/preview

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			OE01	
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks				
G 114	Lecture	Practical	Tutorial	FA			<b>A</b>	Total
Credits	Lecture	Fractical	Tutoriai	FA1	FA2	S	A.	Total
02	02	1	-	10	10	3	0	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. Write basic shell script and Admin commands
- 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	Booting and Shut Down, Shell Scripting 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<sup>th</sup> Edition, McGraw Hill Education, 2017.

#### e-resources:

https://www.coursera.org/learn/system-administration-it-infrastructure-services

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Program:	B. Tech. (Civil Engineering)				Semester: III/IV			
Course:	Material Science				Code: BME23OE01/			OE01/
	(OE-Engineering Science offered by Mech)						BME24	OE01
	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks				Marks
G 11.	Lasture	Practical	Tutorial	FA		SA		Total
Credits	Lecture	Practical	Tutoriai	FA1 FA2		A	Total	
02	02			10	10	3	0	50

#### Prior Knowledge: Nil

#### Course Objectives: This course aims at enabling students,

- 1. To Aquitaine 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)
I	Introduction to materials: Classification of materials, structure of materials :Atomic structure, crystal structure and microstructure, material properties: Physical, Mechanical, Electrical, Magnetic etc.	8
II	Metals: Ferrous, non ferrous, alloys, structure and properties of commonly used metals, applications of metals in engineering.	7
III	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
IV	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<sup>th</sup> Edition 2009.
- 2. Material Science and Metallurgy, Dr. V. D. Kodgire, Everest publishing house, 45th Edition, 2021.

#### Reference Books:

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: III/IV			
Course:	Fundamentals of Mechanical Components and Systems (OE-Engineering Science offered by Mech)				Code: BME23OE03/ BME24OE03			
	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
G 11.	Lecture	Practical	Tutorial	F	4	c	Α.	Total
Credits	Lecture	Fractical	Tutoriai	FA1	FA2	SA		Total
02	02			10	10	3	0	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)
I	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
II	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
III	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
IV	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
<b></b>	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	B. Tech. (Civil Engineering)				IV	
Course:	Techniques and Engineering	l Testing Lab in	Civil		Code:	BC124	VS03
	Teachir	ng Scheme (Hrs./	Week)	Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	Oı	ral	Total
02		04		75	2	5	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, 4<sup>th</sup> Edition, 2013.
- 2. W. A. Nash Strength of Material, Schaum's Outline Series, McGraw Hill, 4<sup>th</sup> edition, 1998.
- 3. S. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd., 3<sup>rd</sup> edition, 1997.
- 4. J. M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co.6<sup>th</sup> edition, 2008.
- 5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 3<sup>rd</sup> 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 WasteWater,
- 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.

Progress Credibility Confidence
Optimism Excellence
Sloce 1999

Program	: B. Tech	n. (Civil Engineerin	Semester: IV						
Course:	Profess AS&H	ional Development	by	Code:	BSH	24AE05			
Credits	Teaching Scheme (Hrs./Week)					Evaluation Scheme and Marks			
Credits	Lecture	Practical	TW	О	R	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.

Unit	Description	Duration [Hrs]
I	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
II	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
III	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
IV	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, 7<sup>th</sup> Edition, McGraw Hill Education Pvt. Ltd.
- 2. ETHNUS, Aptimithra, 2013, 1<sup>st</sup>Edition, McGraw-Hill Education Pvt.Ltd.

#### **Reference Books:**

- 1. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3<sup>rd</sup> Edition, S. Chand Publishing, Delhi.
- 2. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.

# Entrepreneurship/ Economics/ Management Course

(EEM)
SY B Tech
Semester-IV

"Knowledge Brings Freedom"

Progress Credibility Confidence
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Since 1999

Program:	B. Tech. (C	ivil Engineer	ing)	Semeste	Semester: IV						
Course:		Thinking & I	nnovation N	Code:	BSH24EM02						
	`	(Offered by AS&H)									
	1 eacning	Scheme (Hrs	s./ w eek)		Evalua	ation Sche	me and Marks				
Credits	Lecture	Practical	Tutorial	F	FA SA		Total				
	Lecture	Tractical	1 utoriai	FA1	FA2	SA	Total				
2	2	-	-	10	10	30	50				

## Prior knowledge: NA

## **Course Objectives:**

This course aims at enabling students:

- 1. To introduce the students to the concept of Design Thinking and its relevance in innovation
- 2. To equip students with the core concepts, frameworks, and techniques of Innovation management and its applications.
- 3. To help students to understand design thinking as a creative problem-solving approach

#### **Course Outcomes:**

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

- 1. **Explain** the Design Thinking approach for competitive advantage
- 2. **Develop** an understanding for Innovation Function.
- 3. **Demonstrate** strategic foresight for the business models
- 4. **Apply** the techniques of Internet Business Design for business growth

	Detailed <mark>Syllabu</mark> s:	
Unit	Description	Duration [Hrs]
Ι	Introduction to Design Thinking Meaning of Design Thinking, Design thinking for competitive advantage, The Need for Creative and Design, Why design needs entrepreneurial mindset, combining entrepreneurial and design thinking, Opportunity Assessment - "How do we source and identify opportunities?" and "Which opportunities should we invest time and money in?" Three dimensions of Opportunity Assessment - Product-Market fit, Product-Company fit, and Product Business fit. "Go/No-Go" recommendation to invest and initiate.	7
2	Business Challenges and Design Thinking Solutions Paradigm Shift:  The seven steps of design thinking, First Mover and Late mover Advantage, Five Cs of Opportunity Storytelling, Strategic Foresight, Sensing, Value Redefinition, Experience Design, Humanization, Prototyping, Business Model Design	8
3	Innovation Function: Concept of Innovation, Characteristics of Innovation, Sources of Innovation, Types of Innovation, Levels of Innovation, Evolution of Innovation Management, Organizations and Innovation Process, Diffusion of Innovation, Effective innovation management, Performance evaluation, Risk Management in Innovation	7
4	Internet Business Design: Digital/Internet Business Model, Design of Services and Customer Experience. Service sector – IDEO, Lego, E-commerce market players design thinking strategies. Design Thinking and IoT Toward Sustainable Design Thinking. Managing Future Technologies, and minimizing risk of failure.	8
	Total	30

#### **Text Books:**

- 1. Robert Curedale, Design Thinking Process and Methods,5th Edition
- Shalini Rahul Tiwari, Rohit Rajendra 0Swarup: Design Thinking: A Comprehensive Textbook
- Dr. Jalumedi Babu, Dr. Madhu Sudana Reddy G, Ar. Parichita Mohapatra: Innovation and Design Thinking (Paperback.)

#### **Reference Books:**

- Walter Brenner, Falk Uebernickel, Design Thinking for Innovation, Springer Link, 2016.
- Christian Müller-Roterberg, Handbook of Design Thinking, Kindle Direct Publishing, ISBN: 978-1790435371
- Anuja Agarwal, Design Thinking: A framework for applying Design Thinking in Problem Solving, CL India 3.

- 1. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
- 2. <a href="https://www.designdisciplin.com/the-story-of-design-thinking/">https://www.designdisciplin.com/the-story-of-design-thinking/</a>

Program:	B. Tech. (Civil Engineering)						er: IV	
Course:	Project Ma	anagement (C	Offered by A	S&H)		Code:	BSH24EM03	
	Teaching	Scheme (Hr	s./Week)		Evalua	tion Scheme and Marks		
Credits	Lastura	Practical	Tutorial	F	<b>A</b>	SA	T-4-1	
	Lecture	Fractical	Tutoriai	FA1	FA2	SA	Total	
2	2	_	-	10	10	30	50	

Prior knowledge: NA

#### **Course Objectives:**

This course aims at enabling students:

- 1. To help the students gain an understanding regarding the concept of projects and Project Management
- 2. To enable the students to know the key components of project management including time cost & risk.
- 3. To develop analytical and decision-making skills through case studies, simulations and project-based learning.

#### **Course Outcomes:**

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

- 1. **Explain** different stages of project and their significance.
- 2. **Demonstrate** the triple constraints concepts in project management.
- 3. Apply appropriate approaches to plan execute and evaluate projects through case studies.
- 4. Analyze to mitigate the risk associated with projects.

Unit	Detailed Syllabus:  Description	Duration
		[Hrs]
1	Introduction to Project Management:  Concept and Definition of Project, Characteristics of Project, Concept and definition of Project Management, Functions of Project Management, Importance of Project Management, Who is a Project Manager, Roles & Responsibilities of Project Manager. Understanding the Phases in the Life cycle of Projects and their Significance, Different types of Projects: Industrial, Telecommunication, Research and more, Project Selection Methods: Agile method, Waterfall Methods, Scrum Model & Kanban Model, Jira Model.	7
2	The Triple Constraint in Project Management:  The concept of the Triple Constraint in Project Management: Scope, Cost and Time, Project Cost Management: Concept, Consideration, Five types of Costs involved in a project, Cost Management process, Project Time Management and methods of Time estimation, Communications Management in Project, Work Breakdown Structure (WBS). Case studies based on Mega Projects of the World.	8
3	Planning and Execution of Project:  Developing a Mission, Vision, Goals of the project. Concept and definition of Project Planning. Importance of Project Planning. Concept of Project Execution, Phases of Project Execution, Project Evaluation; The Review Technique — Planning and Scheduling of Activity, Networks - Concept of PERT/CPM(Time Estimation in Network Analysis), Assumptions in PERT Modeling — Time cost, Trade-offs, HRM issues in Project Management & How they can be tackled, Reasons for Failures of Project, Case Study with respect to different Domains	7
4	Project Monitoring and Risk Management:  Concept of Project Monitoring, How to Building a SuitableMonitoring; ControlSystem, ConceptofConflictManagement,Concept & Definition of Risk and Risk Management, Concept of Risk Matrix Analysis ,Strategies to Manage Risks ,An Overview of Useful Techniques and Tools Used in Project Management. Case Studies with respect to different Domains.	8
	Total	30

## Department of Civil Engineering

#### **Text Books:**

1. Joseph Heagney, Fundamentals of Project Management, American Management Association, 2012

#### **Reference Books:**

- 1. Erik W Larson, Clifford Gray, Rohit Joshi; Project Management-The managerial process, MacGraw Hill Publication, 2021
- 2. Punmia, Project Management with CPM / PERT, Laxmi Publications, 2001
- 3. Robert L Kimmons, Project Management Basics, Taylor & English English Ltd, 2018
- 4. N. D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

- 1. https://www.entrepreneur.com/
- 2. http://dst.gov.in/scientific-programme/t-d-tdb.htm



Program:	B. Tech. (	Civil Engine	eering)	Semest	er: IV			
Course:	Fostering	Entreprene	urship and	Startups		Code:	BSH24EM04	
	(Offered by AS&H)							
	Teaching	BME23OE0	1Scheme	tion Sahama and Marks				
		(Hrs./Week)	Evaluation Scheme and Marks					
Credits	Lecture	Practical	Tutorial	F	FA	SA	Total	
	Lecture	Fractical	Tutoriai	FA1	FA2	SA	1 Otal	
2	2	-	-	10	10	30	50	

Prior knowledge: NA

## **Course Objectives:**

This course aims at enabling students:

- 1. To inculcate an entrepreneurial mindset into the minds of young professionals
- 2. To enable the students to evaluate challenges relating to new ventures.
- 3. To provide the students an understanding about different skills for founding, leading & managing startups

#### **Course Outcomes:**

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

- 1. Explain the concepts and role of entrepreneurship.
- 2. Identify new venture opportunities in today's Business world.
- 3. Analyze strategic choices in relation to the growth of new ventures
- 4. Correlate the Startup opportunities and key factors supporting the Start up Culture

## **Detailed Syllabus:** Unit Duration **Description** [Hrs] The Entrepreneurial Perspective: Why to become entrepreneur ,Characteristics of an Entrepreneur, Functions of an Ι Entrepreneur, Types of Entrepreneurs, Distinction between Entrepreneur and Manager The 7 entrepreneurial decision process, Role of entrepreneur in economic development, future of entrepreneurs, Concept of Business Opportunity, Business Opportunities Identification Process.. **Creating & Starting Ventures:** 2 Concept of business idea, Sources of new idea generation, Methods of Idea generation, Creative problem solving, Product planning and development, Business Structure, Creating a Business Plan, Market Size Analysis, Legal issues and Regulations to set up a business, Business Patents, Trademarks, Copy rights, Trade secrets, Licensing. **Managing and Growing a New Business Venture:** Attractiveness of a new entry opportunity- Entry strategy for new entry exploitation- risk 3 reduction strategies for new entry exploitation, Growth Strategies – economic implications of 7 growth, overcoming pressures on existing financial resources, human resources, management of employees and entrepreneur's time, Sustaining a Business turbulence, Government incentives & Schemes. The Startup Ecosystem in India: Meaning of Startup, Types of Start-ups, The Rise of The Startup Economy, Startup Policy, Startup opportunities, and Financial support for Start ups. Recent initiatives including Start up India, Make in India, Digital India, and Policies for technology Start-ups, E- commerce Startups, Tech Support and Proto type Development centers. Start up Infrastructures: Co -Working Space, Market development initiatives.. 30 Total Text Books: 1. C. B. Gupta and N. P. Srinivasan, Entrepreneurial Development, Sultan Chand & Devel

## Department of Civil Engineering

## **Reference Books:**

- 1. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning, 2016.
- 2. Peter F. Drucker, Innovation and Entrepreneurship.
- 3. Satish Taneja, S.L.Gupta, Entrepreneurship Development New Venture Creation
- **4.** Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneur's Road Map, 2e, Routledge
- 5. <u>Vasant Desai</u>, <u>Dynamics of Entrepreneurship Development</u>,

- 1. https://www.entrepreneur.com/
- 2. http://dst.gov.in/scientific-programme/t-d-tdb.htm



Program:	B. Tech. (C	Civil Enginee	Semeste	er: IV				
Course:	Business Fir	nance for Eng	gineers (Offe	ered by AS	S&H)	Code:	BSH24EM05	
Credits	Teaching S	Scheme (Hrs.	./Week)		Evalua	tion Scheme and Marks		
Credits	Lastuma	Practical	Tutorial	I	F <b>A</b>	C A	T-4-1	
	Lecture	Practical	Tutoriai	FA1	FA2	SA	Total	
2	2	_	-	10	10	30	50	

## Prior knowledge of: NA

#### **Course Objectives:**

This course aims at enabling students

- 1. The inculcate the knowledge of the core concepts of business finance and its importance in managing a business
- 2. To improve students 'understanding of the time value of money concept and the role of finance in the current competitive business scenario.

## **Course Outcomes:**

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

- 1. **Explain** the concept of Business Finance and financial planning.
- 2. **Apply** the concept of capitalization in Business Organizations.
- 3. **Analyze** Financial markets and the role of financial institutions in Business Development.
- 4. **Evaluate** the role of Financial System in Business

Da	tail	hal	Cvl	lal	ous:
De	ы	eп	<b>3</b> V		DUS:

Unit	Description	Duration [Hrs]
I	Business Finance: Concept of Business Finance, Objective and Scope, Significance of Finance, principles of business finance, Finance Function, Business finance v/s corporate finance, Source of Finance. Meaning of financial planning, steps in financial planning, significance of financial planning, essential features of a good financial plan, Personal financial planning, Types of financial plan.	7
2	Capitalization: Introduction to capitalization, Amount of Capitalization, Over Capitalization, Under Capitalization, Venture Capital - Meaning of Venture Capital, Method of Venture Financing, Venture Capital Funds, Policies and Procedures adopted by Venture Capitalists, Venture Capital in India, Guidelines for Venture Funds.	8
3	Financial Markets, Institutions, and instruments: Introductions to Financial Markets: Nature, Functions and Types of Financial markets, Different Financial Instruments, Sources of financing: Shares, Debentures, Term Loans, Retained Earnings, Public Deposits, Bonds, Trade Credit, Mutual Funds - Definition, Types of Mutual Funds, Significance of Mutual Funds; Case Studies on Financial Markets.	7
4	Constituents of the Financial System and Regulatory Institutions:  Classification: Fund Based, Non Fund Based and Modern Services, Hire Purchasing, Leasing: Lease Financing - Essential Elements of Leasing, Types of Leases, Merits and Demerits of Lease Financing, Merchant Banking - Role; Functions of Merchant Banking, Factoring. Debt management, Portfolio Management.  RBI - Organization, objectives, role and functions, monetary policy of RBI, NABARD, SEBI - Organization and Objectives	8
	Total	30

#### **Text Books:**

- 1. Srivastava, R.M. Essentials of Business Finance, Himalaya Publishing House, Kalyani Publications
- 2. Chandra, Prasanna. Financial Management, Mc Graw Hill, New Delhi.

#### **Reference Books:**

- 1. Gordon, E. & Natarajan, K. Financial Markets and Institutions, Himalaya Publishing House.
- 2. Khan and Jain, Financial Management, Tata McGraw Hill, 2008
- 3. Singh, Preeti. Investment Management. Himalaya Publishing House,
- 4. Kale, N.G. Business Organization. Manisha Publications.

- 1. https://www.youtube.com/watch?v=TgF2XvjquUU&list=PLLy\_2iUCG87CXY2B6fPex1SOIq xzzD5Wj
- 2. https://www.youtube.com/watch?v=CCQwz\_Gwo6o
- $\textbf{3.} \ https://www.youtube.com/watch?v=OT5RdoJAkhY\&list=PLPjSqITyvDeUTeAOGhip\_ubjN3y8oqT13}$



## Value Education Course

(VEC)
SY B Tech
Semester-IV

"Knowledge Brings Freedom"

Progress Credibility Confidence
Optimism Excellence

Since 1999

Program:	B. Tech. (Civil	Engineering)	Semester:	IV						
Course :	<b>Constitution of</b>	India	Code:	BSH24VE02						
	Teaching Scheme I						valuation Scheme			
Credit	Lastrons	Dunatical	Testoniol	FA	FA		Total			
	Lecture	Practical	Tutorial	FA1 FA2		SA	Total			
2	2	-	-	25	25	-	50			

## Course Objectives:

- 1. Provide an overview of the historical context leading to the framing of the Indian Constitution.
- 2. Study the fundamental rights enshrined in the Constitution and their application.
- 3. Study the structure and functions of key constitutional institutions like the President, Parliament, and Judiciary.

#### Course Outcomes:

After learning the course, the students will be able to

- 1. **Comprehend** Fundamentals of Indian Constitution.
- 2. **Review** Constitutional Institutions
- 3. Evaluate Constitutional Amendments

Detail <mark>ed Syllab</mark> us:		
Unit	<b>Description</b>	Duration (Hrs)
1	<ul> <li>Fundamentals of Indian Constitution</li> <li>Introduction to the Indian Constitution: Historical background, making of the Constitution, and its significance</li> <li>Preamble: Understanding the importance and interpretation of the Preamble to the Constitution · Fundamental Rights, Directive Principles of State Policy</li> <li>Analyze the salient features of the Indian Constitution</li> </ul>	7
	Structure and Functioning of Government	
2	<ul> <li>Union Executive: Study of the President, Vice-President, Prime Minister, and Council of Ministers, along with their powers and functions</li> <li>Parliament: Understanding the composition, powers, and functioning of the Lok Sabha and Rajya Sabha</li> </ul>	8
	<ul> <li>Judiciary: Analysis of the structure, independence, and functioning of the Supreme</li> </ul>	
	<ul> <li>Court and High Courts</li> <li>Federalism: Examination of the division of powers between the Union and States, along with the role of institutions like Governors and State Legislatures</li> </ul>	
	Constitutional Amendments and Legal Framework	
3	<ul> <li>Amendment Process: Understanding the procedure for amending the Constitution and significant amendments</li> <li>Constitutional Bodies: Study of institutions like the Election Commission, Comptroller and Auditor General, and their constitutional roles</li> </ul>	7
	• Emergency Provisions: Analysis of the provisions related to national emergency, state	
	<ul> <li>emergency, and financial emergency</li> <li>Constitutional Remedies: Detailed study of writs, judicial review, and other constitutional remedies available to citizens</li> </ul>	
4	<ul> <li>Contemporary Issues and Challenges</li> <li>Judicial Activism: Analysis of the role of the judiciary in addressing contemporary issues and ensuring constitutional principles</li> <li>Constitutional Governance: Examination of challenges to constitutional governance,</li> </ul>	8
	including federalism, secularism, and social justice	
	<ul> <li>Constitutional Amendments: Critique of recent constitutional amendments and their implications on democracy and governance</li> </ul>	
	Comparative Constitutional Law: Comparison of the Indian Constitution with other constitutions to understand global constitutional trends and best practices	
	Total	30

#### Text Books:

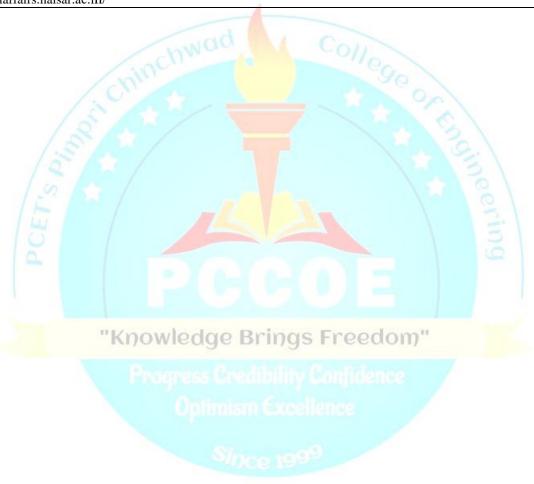
- **1.** E 1. Durga Das Basu, —Introduction to the Constitution of India —, Prentice Hall of India, New Delhi,24th edition, 2020, ISBN-109388548868
- 2. Clarendon Press, Subhash C, Kashyap, Our Constitution: An Introduction to India's Constitution and constitutional Lawl, NBT, 5th edition, 2014, ISBN-9781107034624

#### Reference Books:

- Maciver and Page, —Society: An Introduction Analysis —, Laxmi Publications, 4th edition, 2007, ISBN 100333916166
- 2. PM Bhakshi, —The constitution of Indial, Universal Law Publishing An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375
- 3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi.
- 4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.

#### e-sources:

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.