



COURSE CURRICULUM

B.Tech Fire & Environment, Health,
Safety Engineering (F&EHS)

Batch:2025-2026
Academic Year: 2025-26
Updated on: Aug,2025

B.Tech in Fire & Environment, Health, Safety (F&EHS) Course Curriculum

Academic Year: 2025-26

W.e.F. July 2025



GSFC
UNIVERSITY
EDUCATION RE-ENVISIONED

**GSFC University, Vigyan Bhavan, P. O. Fertilizernagar,
Vadodara - 391750, Gujarat, India**

VISION

- GSFCU strives to be the best compact boutique institution with a futuristic approach, encouraging student centric culture and sharpened focus on developing industry ready & employable students with all-round development.

MISSION

- Establish an institution, which promotes creativity and innovation.
- Develop unique quality standards for academic excellence and pedagogical innovations.
- Remain agile through learning ecosystem with flexible processes & systems.
- Holistic growth for industry readiness.

No.	Programme Outcomes (POs)	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialisation to the solution of complex engineering problems.	Cognitive domain	Apply
PO2	Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	Cognitive domain	Apply
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.	Cognitive domain	Create
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to arrive at valid conclusions.	Cognitive domain	Evaluate
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of their limitations.	Cognitive domain	Create

PO6	The engineer and the society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	Cognitive domain	Apply
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of the need for sustainable development.	Cognitive domain	Understand
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Cognitive domain	Remember
PO9	Individual and team-work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Cognitive domain	Apply
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.	Cognitive domain	Understand Remember
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Cognitive domain	Remember Understand Apply
PO12	Life-long learning: Recognise the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Cognitive domain	Understand Create



No.	Programme Specific Outcomes (PSOs)	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
PSO1	An ability to identify the hazards, evaluate the risk in the workplace and suggest suitable mitigation measures	Cognitive domain	Remember Evaluate Create
PSO2	An ability to assess fire load in various occupancies and suggest suitable fire prevention, protection and life safety measures	Cognitive domain	Evaluate Analyse
PSO3	An ability to evaluate the occupational diseases in the workplace and provide welfare and applicable medical facilities	Cognitive domain	Apply Create
PSO4	An ability to understand environmental issues associated with the workplace to design the control measures with traditional and computational tools based on codes and legislations	Cognitive domain	Understand Analyse Create

Mapping of POs & PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PSO1	1	1	3	3	3	1	2	3	1	3	3	3
PSO2	2	2	1	3	1	3	1	1	3	1	3	1
PSO3	3	3	3	1	3	3	2	2	3	2	2	3
PSO4	2	2	3	2	3	2	3	1	2	1	3	3
Avg.	2	2	3	2	3	2	2	2	2	2	3	3

1: Slight (Low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Definition of Credit:

Definition of Credit:

1 Hour. Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
4 Hours Practical (P) per week	2 credit



2 Hours Practical (P) per week	1 credit
1 Hour Practical (P) per week	0.5 credit
3 Hours Experiential learning	1 credit

Course code Definitions:

Lecture	L
Tutorial	T
Practical	P
Basic Science Courses	BSC
Engineering Science Courses	ESC
Humanities and Social Sciences including Management courses	HSMC
Professional core courses/Major (Core)	PCC
Professional Elective courses/Minor Stream	PEC
Open Elective courses	OEC
Laboratory course	LC
Mandatory courses	MC
Non-credit courses	NC
Project (Experiential learning)	PROJ
Experiential learning ex. Internship, Industrial Visit, Field visit, etc.	EL
Multidisciplinary courses	MDC
Ability Enhancement Course	AEC
Skill Enhancement Course	SCE
NPTEL Online course	NOC
Value Added Courses	VAC



Structure of Undergraduate Programme:

Structure of Undergraduate Program		
Sr. No.	Category of Course	Credit
1	Humanities and Social Sciences courses	12
2	Basic Science courses	20
3	Engineering Science courses	34
4	Professional Core courses	66
5	Professional Elective courses	6
6	Open Elective courses	5
7	Project work, seminar and internship	22
8	Value Added courses	5
9	Fire Drills	8
Total		178

Category-wise Courses:

1. Humanities & Social Sciences Courses

(i) Number of Humanities & Social Science Courses: 2

(ii) Credits: 4

Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	AECC101	Fundamentals of English	I	2	0	0	2	2	0	0	2
2.	AECC201	Communication Skills in English	II	2	0	0	2	2	0	0	2
		Total					4				4

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component,

**ES - End Semester****2. Basic Science Course**

(i) Number of Basic Science Course: 4

(ii) Credits: 16

Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTPY104	Engineering Physics	I	3	2	0	4	3	1	0	4
2.	BTMA102	Mathematics – I	I	3	0	1	4	3	0	1	4
3.	BTCY205	Engineering Chemistry	II	3	2	0	4	3	1	0	4
4.	BTMA203	Mathematics – II	II	3	0	1	4	3	0	1	4
5.	BTMA301	Mathematics III	III	3	0	1	4	3	0	1	4
Total							20				20

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

3. Engineering Science Course

Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTEC101	Basics of Electrical & Electronics	I	3	2	0	5	3	1	0	4
3.	BTME105	Engineering Workshop Practices	I	0	2	0	2	0	1	0	1
4.	BTFS108	Fundamental of Fire & Environment, Health, Safety	I	2	0	0	2	2	0	0	2
5.	BTME202	Engineering Graphics	II	0	4	0	4	0	2	0	2
6.	BTME204	Engineering Mechanics	II	4	2	0	6	3	1	0	4
8.	BTME209	Python Programming	II	3	2	0	5	3	1	0	4
9.	BTFS313	Town Planning & Building Design	III	3	2	0	5	3	1	0	4
10.	BTFS314	Strength of Materials	III	3	2	0	5	3	1	0	4



11	BTFS315	Machine Design & Industrial Drafting	III	4	2	0	6	4	1	0	5
12	BTFS416	Fluid mechanics & Pumping machinery	IV	3	2	0	5	3	1	0	4
Total							51				34

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

4. Professional Core Courses

(i) Number of Professional Core Courses: 20

(ii) Credits: 66

Sr. No	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTFS311	Safety Management I	III	3	0	0	3	3	0	0	3
2.	BTFS312	Legislations related to Fire & EHS	III	3	0	0	3	3	0	0	3
3.	BTFS411	Building Fire Prevention & Protection measures	IV	3	0	0	3	3	0	0	3
4.	BTFS412	Hazard Identification, Risk assessment & Control techniques	IV	3	0	1	4	3	0	1	4
5.	BTFS413	Safety in Construction Industry	IV	3	0	0	3	3	0	0	3
6.	BTFS414	Basics of Occupational Health	IV	3	0	0	3	3	0	0	3
7.	BTFS511	Fire Service Operations	V	3	0	0	3	3	0	0	3
8.	BTFS512	Safety Management II	V	3	0	0	3	3	0	0	3
9.	BTFS513	First Aid & Basic Life Support	V	2	2	0	4	2	1	0	3
10.	BTFS514	Hazardous Waste Management	V	2	0	0	2	2	0	0	2
11.	BTFS515	Introduction to Fire Dynamics	V	3	2	0	5	3	1	0	4
12.	BTFS601	Safety Engineering	VI	3	0	0	3	3	0	0	3
13.	BTFS602	Fire Protection Systems	VI	4	0	0	4	4	0	0	4



14.	BTFS603	Industrial Hygiene & Toxicology	VI	3	2	0	5	3	1	0	4
15.	BTFS604	Environmental Pollution & Control Measures	VI	3	2	0	5	3	1	0	4
16.	BTFS701	Structural Behaviour & Passive Fire Protection	VII	3	0	0	3	3	0	0	3
17.	BTFS702	Managing Occupational Health	VII	3	2	0	5	3	1	0	4
18.	BTFS703	Safety Inspections & Audits	VII	1	2	1	4	1	1	1	3
19.	BTFS704	Environmental Impact Assessment	VII	3	0	0	3	3	0	0	3
20.	BTFS705	Fire & Safety in Major Accident Hazard Units	VII	4	0	0	4	4	0	0	4
Total							72				66

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

5. Professional Elective Courses

(i) Number of Professional Elective Course: 2

(ii) Credits: 6

Sr. No	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTFS605A	Smoke Control System	VI	3	0	0	3	3	0	0	3
2.	BTFS605B	Behaviour Based Safety	VI	3	0	0	3	3	0	0	3
3.	BTFS605C	Climate Change and Sustainability	VI	3	0	0	3	3	0	0	3
4.	BTFS706A	Fire Investigation	VII	3	0	0	3	3	0	0	3
5.	BTFS706B1	Process Safety	VII	3	0	0	3	3	0	0	3
6.	BTFS706C	Wastewater Engineering	VII	3	0	0	3	3	0	0	3
Total							20				6

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

6. Open Elective Courses:

(i) Number of Open Elective Courses: 1

(ii) Credits: 3



Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTOE07	Industrial Safety	VI	3	0	0	3	3	0	0	3
2.	BTOE08	Fire Science	VI	3	0	0	3	3	0	0	3
3	NOC501	NPTEL ONLINE COURSE	V	0	0	0	2	0	0	2	2
		Total					5				5

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

7. Project Work, Seminar And Internship In Industry Or Elsewhere

(i) Number of Project Work, Seminar And Internship In Industry Or Elsewhere: 10

(ii) Credits: 26

Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1	VACC101	Foundation Course	I	0	0	0	4	0	0	0	4
2	VACC201	Tinkering & Mentoring	II	0	0	2	4	0	0	2	1
3	BTFS208	Industrial Internship	II	0	0	0	2	0	0	0	2
4	BTFS317	Industrial Internship	III	0	0	0	2	0	0	0	2
5	BTFS409	Industrial Internship	VI	0	0	0	2	0	0	0	2
6	BTFS517	Industrial Internship	V	0	0	0	2	0	0	0	2
8	BTFS607	Industrial Internship	VI	0	0	0	2	0	0	0	2
9	BTFS707	Industrial Internship	VII	0	0	0	2	0	0	0	2
10	BTFS708	Minor Project	VII	0	4	0	2	0	4	0	2
11	BTFS801	Major Project	VIII	0	16	0	8	0	16	0	8
		Total					20				27

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8. Mandatory Courses [Environmental Sciences, Induction Programme, Indian Constitution, Essence of Indian Knowledge Tradition]

(i) Number of Ability Enhancement Courses: 4

(ii) Credits: 8

Sr. No.	Course	Course Name	Semester	Teaching Scheme (Hours/week)	Teaching Credit
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.	Code			L	P	T	Total	L	P	T	Total
1	AECC301	Entrepreneurship Development	III	2	0	0	2	2	0	0	2
2	AECC401	Environmental Studies	IV	2	0	0	2	2	0	0	2
3	AECC501	Disaster Risk Management	V	2	0	0	2	2	0	0	2
4	AECC601	Indian Constitution	VI	2	0	0	2	2	0	0	2
		Total					8				8

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

9. Skill Enhancement Courses

(i) Number of Skill Enhancement Courses: 4

(ii) Credits: 8

Sr. No	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1	BTFS316	Fire drills & Practical	III	0	4	0	4	0	4	0	2
2	BTFS 406	Fire drills & Practical	IV	0	4	0	4	0	4	0	2
3	BTFS516	Fire drills & Practical	V	0	4	0	4	0	4	0	2
4	BTFS606	Fire drills & Practical	VI	0	4	0	4	0	4	0	2
		Total					16				8

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

10. Research Project / Dissertation

(i) Number of Research Project / Dissertation: 2

(ii) Credits: 10

Sr. No	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTFS708	Minor Project	VII	0	4	0	2	0	4	0	2
2.	BTFS801	Major Project	VIII	0	16	0	8	0	16	0	8
		Total					10				10

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

About the Programme (Max 1000 words):

Fire & EHS has become very important in view of rapid industrialization, development of new technology and consequent enactment of various legislation for ensuring safety & security of the property & life. GSFC University being a CSR initiative of GSFC Ltd that has Fire station, Fire tenders, Skilled & professionals in the field of Fire & Environment, Health, Safety provides the right environment for creating Industry ready Fire & EHS engineers to the society. Students will gain and apply knowledge of fundamental concepts such as Fire prevention techniques, Fire protection system & its design, Fire -fighting systems & its applications, Safety management, Hazard Identification, Risk Assessment & Control Techniques, Legislations related to Fire & Environment, Health, Safety, Safety Engineering, Industrial Hygiene & Health, Occupational Health & First Aid, Environment Management Techniques, Municipal Solid & hazardous waste management, Process safety management etc. Students will be able to demonstrate rescue techniques to work as a team in a multidisciplinary environment.

Teaching Scheme

Semester –I

Sr. No	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTEC101	Basics of Electrical & Electronics	3	2	0	5	3	2	0	4	20	30	50	100	50	150
2	BTMA103	Mathematics – I	3	0	1	4	3	1	0	4	20	30	50	100	--	100
3	BTPY106	Engineering Physics	3	2	0	5	3	0	2	4	20	30	50	100	50	150
4	BTCS106	ICT Workshop	0	2	0	2	0	2	0	1	20	30	50	--	50	50
5	BTFS108	Fundamentals in Fire & Environment, Health, Safety	2	0	0	2					20	30	50	100		100
6	VACC 101	FOUNDATION COURSE	0	0	0	4	0	0	0	4	--	--	--	--	100	100
		Total	11	6	1	22										650

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Components - End Semester

School of Technology

B.Tech Fire &Environment,Health,Safety,(F&EHS)

Academic Year, 2025-26





COURSE CODE BTEC101	COURSE NAME BASIC OF ELECTRICAL AND ELECTRONICS	SEMESTER 1
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	NIL
Course Category	Engineering Science
Course focus	Skill development
Rationale	Basic electrical and electronics knowledge is essential for understanding modern technology, from everyday applications to career opportunities. It provides a foundation for working with computers, telecommunications, renewable energy, and more. It promotes safety by teaching proper handling of electricity and hazard awareness. This knowledge enables DIY projects, repairs, and problem-solving skills. It also contributes to environmental sustainability by understanding energy consumption and designing efficient systems.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: Emphasize the fundamental concepts and overview of Electrical Engineering & Electronics. 2: Imparting fundamental knowledge on electronic components 3: To provide brief idea about electrical machines 4: To be aware about communication engineering concepts 5: To gain knowledge about test equipment of electrical and electronics.



Course Content (Theory)	Weightage	Contact hours
Unit 1: Electrical Engineering Theory: Study of voltage, current, power & energy. Application of Ohm's law, Kirchhoff's law, Lenz law. Electromagnetic induction through the working of a transformer.	20%	10
Unit 2: Concept of 1-phase, 3-phase AC supply. Theory: Introduction of terms like RMS value, average value. Familiarity with components like resistors, capacitors, diodes, LED's, their application, uses, industrial specification. Introduction to component data sheets.	25%	10
Unit 3: Electrical Machines Theory: Understanding the construction, type, principle of operation of various motors like DC, Stepper, Servo, AC. Introduction to the concepts of motor selection and sizing.	25%	10
Unit 4: Electronics Engineering Theory: Introduction of electronic components like diodes, LED's, transistors, O Amps, Gates Industrial specification and data sheets of the components. Characteristics and usage of the components. Signals: Analog & Digital. Introduction to industrial data acquisition.	20%	10
Unit 5: Test Equipment Theory: Introduction to Multimeter and Oscilloscope.	10%	5

List Of Practical	Weightage	Contact hours
1: Symbols of Electrical & Electronics equipment, Basics of Electrical safety & Study of Electrical Safety rules	20%	3
2: Patch cords, Digital Multimeter (DMM), Familiarization with Digital multimeter (DMM).	20%	3
3: Measurement of AC Voltage at 230 V AC Mains plug, Measurement of DC Voltage for cell phone battery of 3.8 V DC, Measurement of Resistance of Current coil & Potential coil of Energy meter, Measurement of Continuity of any wire/fuse.	20%	3
4: Study the basics of phase control transformer & verify its turn-ratio, Familiarization with Digital Storage Oscilloscope (DSO)	20%	3
5: Understand the construction & working of energy meter, Load Test on 1 Phase AC CSCR Type AC Motor, Load Test on DC Shunt Motor.	20%	3

Instructional Method and Pedagogy: Teaching basic electrical and electronics, a combination of instructional methods and pedagogies can be employed to enhance learning. A hands-on approach, such as laboratory experiments, allows students to directly engage with circuits and electronic components, reinforcing theoretical concepts.



Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Apply the concepts of limits, continuity and derivatives to solve problems. CO2: Determine convergence or divergence of sequences and series. CO3: Use Taylor and MacLaurin series to represent functions. Solve application problems. CO4: Understand functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations. CO5: To deal with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manner.	Cognitive Cognitive Cognitive Cognitive Cognitive	Apply Determine Apply Understand Apply

Learning Resources	
1.	Reference Books: 1. Thomas, G.B., Finney, R.L., Calculus and Analytic Geometry, 9th Ed., Wesley/Narosa, (1998).
2.	Journals & Periodicals: 1. Journal of Electrical Engineering and Electronics 2. IET Power Electronics 3. International Journal of Electronics 4. IEEE Transactions on Education:
3.	Other Electronic Resources: 1. www.electronicsclub.info 2. www.circuitlab.com



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	0	0
CO2	0	3	0
CO3	0	2	0
CO4	0	0	1
CO5	0	0	3

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	0	0	0	2	0	0	1	0	0	3
CO2	3	0	0	0	0	1	0	0	2	0	0	3
CO3	3	0	0	0	0	1	0	0	2	0	0	3
CO4	3	0	0	0	0	2	0	0	2	0	0	3
CO5	3	0	0	0	0	1	0	0	1	0	0	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTCS103	COURSE NAME MATHEMATICS-I	SEMESTER-1
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	1	4	3	0	1	4



Course Pre-requisites	Differentiation and Integration (Basic calculus), Trigonometry
Course Category	Basic Science
Course focus	Skill Development
Rationale	Mathematics is essential for everyday life, providing practical applications and problem-solving skills. It forms the foundation for science, technology, engineering, and mathematics (STEM) fields. Learning mathematics enhances cognitive development, including critical thinking and analytical skills.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	1: Gives a clear understanding of the ideas of calculus as a solid foundation for subsequent courses in mathematics and other disciplines. 2: Comprehensive focus on teaching calculus based on concepts as well as procedures. 3: Enables students to apply their knowledge and solve practical problems in physical sciences and engineering. 4: Understanding basic concepts of linear algebra (systems of linear equations, matrix calculus, vectors and basic vector operations) 5: Solving computational problems of linear algebra



Course Content (Theory)	Weightage	Contact hours
Unit 1: Theory: Review of limits, continuity, and differentiability of function of single variable; indeterminate forms and 'Hospital's Rule.	20%	07
Unit 2: Theory: Sequences and series, Tests for convergence of series (nth term, Comparison, limit comparison, Ratio, Root, Integral, Geometric series, Alternating series), Power Series, Taylor Series, Maclaurin's Series.	20%	10
Unit 3: Partial Derivatives: Theory: Limit and continuity of functions of two variables, chain rule, total derivatives, Taylor's series expansion of function of two variables.	20%	10
Unit 4: Applications of Partial Derivatives: Theory: Maxima and minima, Lagrange multipliers, errors and approximation, implicit functions, tangent plane and normal to a surface.	20%	08
Unit 5: Linear Algebra: Theory: Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linear simultaneous equations. Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew- Hermitian, Normal & Unitary matrices and their elementary properties. Characteristic polynomials, Eigen- values and Eigenvectors of a matrix, Cayley Hamilton theorem (without proof) and its use in finding the inverse of a matrix. Applications of Matrices.	20%	10

List Of Practical Tutorial	Weightage	Contact hours
Unit 1: 1. Limits, Continuity, Differentiability of one variable functions. 2. Limits, Continuity, Differentiability of two variable functions.	20%	3
Unit 2: 1. Partial Derivatives: Total Derivatives, Composite functions. 2. Application of Partial Derivatives: Maxima – Minima of functions, Taylor's Series.	20%	3
Unit 3: 1. Application of Partial Derivatives: Tangent Plane Normal line, Error approximation. 2. Matrices: Rank and Inverse of matrix.	20%	3
Unit 4: 1. Matrices: Solution of System of linear equations. 2. Eigen values and Eigenvectors of a matrix.	20%	3
Unit 5: 1. Convergence and Divergence of Sequence. 2. Convergence and Divergence of Series.	20%	3



Instructional Method and Pedagogy: For engineering mathematics, an effective instructional method involves a combination of problem-based learning, active learning, and technology integration. Engage students in solving real-world engineering problems, promoting critical thinking and application of mathematical concepts. Utilise visualisations, demonstrations, and mathematical software to enhance understanding.

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Apply the concepts of limits, continuity and derivatives to solve problems.	Cognitive	Understand
CO2: Determine convergence or divergence of sequences and series	Cognitive	Understand
CO3: Use Taylor and MacLaurin series to represent functions. Solve application problems.	Cognitive	Apply
CO4: Understand functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations.	Cognitive	Understand
CO5: To deal with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manners.	Cognitive	Apply

Learning Resources	
1.	Reference Books: Thomas, G.B., Finney, R.L. Calculus and Analytic Geometry, 9th Ed., Wesley/Narosa, (1998).
2.	Journals & Periodicals: 1. Journal of Optimization Theory and Applications 2. Journal of Mathematical Modelling and Algorithms 3. SIAM Journal on Applied Mathematics 4. Mathematical Problems in Engineering
3.	Other Electronic Resources: 1. www.onlinemathlearning.com 2. www.mathway.com



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	2	2
CO2	0	0	1
CO3	0	0	0
CO4	0	2	2
CO5	0	2	3

Mapping of POs & COs



	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	2	3	1	1	0	0	0	0	1	0	2
CO2	2	1	1	0	0	0	0	0	0	1	0	0
CO3	2	1	2	1	0	0	0	0	0	1	0	1
CO4	3	2	2	2	1	0	0	0	0	1	0	2
CO5	3	2	3	3	1	0	0	0	0	1	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTCS104	COURSE NAME COMPUTER PROGRAMMING-I	SEMESTER-1
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4



Course Pre-requisites	NIL
Course Category	Engineering Science
Course focus	Skill Development
Rationale	Learning C programming is essential due to its versatility, efficiency, and portability. It provides low-level control and high-level abstraction, making it suitable for a wide range of applications. C offers access to system-level functions, enabling interaction with hardware and development of performance-critical software.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To provide the basics of programming components. 2: To develop logics for array and string which will help them to create applications in C. 3: To familiarise students with functions and pointers. 4: To give brief idea about structures in c programming 5: To gain knowledge about file handling using c language.



Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to programming paradigms Structure of C program - C programming: Data Types, Storage Classes, Constants, Enumeration Constants, Keywords, Operators, Precedence and Associativity, Expressions, Input / Output statements, Assignment statements, Decision making statements, control structure	20%	09
Unit 2: ARRAYS AND STRINGS Theory: Introduction to Arrays: Declaration, Initialization, One dimensional array, two dimensional arrays. Addition scaling determinant and Transpose, string operation:- length, compare, concatenate, copy, bubble sort, linear and binary search.	20%	09
Unit 3: FUNCTIONS AND POINTERS Theory: Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions), Recursion, Pointer, pointer operators, Pointer arithmetic: Arrays and pointers, Array of pointers, Parameter passing: Pass by value, Pass by reference	20%	09
Unit 4: STRUCTURES Theory: Structure: Nested structures, Pointer and Structures, Array of structures, Self-referential structures, typedef, Dynamic memory allocation: malloc, calloc, realloc, free().	20%	09
Unit 5: FILE PROCESSING Theory: Files and file handling operations, types of file processing: Sequential access, Random access, Sequential access file, Command line argument.	20%	09



List Of Practical	Weightage	Contact hours
1: (1) Program to print “Hello GSFC University”. (2) Program to find the sum of the 2 numbers. (3) Program to find area and circumference of the circle. (4) Program to find simple interest. (5) Program to convert degree centigrade to Fahrenheit. (5) Program to calculate sum of 5 objects and print average. (6) Program to show swapping of 2 numbers without using the third variable. (7) Program to show swapping of 2 numbers using a third variable. B. Control Structures: IF, Switch, Loops (8) Program to show reverse of given number. (9) Program to find greatest among 3 numbers. (10) Repeat program 10 with conditional operator. (11) Program to find that entered year is Leap year or not. (12) Program to find the given number is even or odd. (13) Program to use Switch statement, Display percentage of student. (14) Program to display arithmetic operations using Switch. (15) Program to display first 15 natural numbers and their sum using For Loop. (16) Program to print Patterns (17) Program to print Fibonacci series till 40. (18) Program to find factorial of given number. (19) Program to find whether a given number is prime or not.	20%	6
2: (20) Program to create an array of 10 elements. Show the sum and average of 10 elements entered by the user. (21) Program to find maximum number in given Array. (22) Program to display matrix. (23) Program to find sum of two Matrices. (24) Program to find subtraction of two matrices. (25) Program to find multiplication of two matrices.	20%	6



3: (26) Program to find factorial of given number using function. (27) Program to show table of given number using function. (28) Program to show call by value. (29) Program to show call by reference. 36. Program to find the largest among two using functions. (30) Write a program to show how similar name variables can be used in different functions. (31) Write a program to return more than one value from a function. (32) Program for passing array from main function to display function. (33) Write a program in C to show the basic declaration of pointer. (34) Write a program in C to demonstrate how to handle the pointers in the program. (35) Write a program in C to demonstrate the use of &(address of) and *(value at address) operator. (36) Write a program in C to add two numbers using pointers. (37) Write a program in C to add numbers using call by reference. (38) Write a program in C to store n elements in an array and print the elements using a pointer.	20%	6
4: (38) Write a program to demonstrate declaration of structures. (39) Write a program to store student information using Structure. (40) Write a program to add two distances. (41) Write a program to store 10 student's information using structures. (42) Write a program to demonstrate nested structures. (43) Write a program to demonstrate how pointers will be used to create and access structure	20%	6
5: (44) Write a program to create a file and store information. (45) Write a program to read contents from a file. (46) Write a program to append content at the end of file.	20%	6

Instructional Method and Pedagogy: C programming, an effective instructional method involves a combination of hands-on programming, step-by-step guidance, code review and feedback, collaborative learning, and real-world application. Engage students in practical coding exercises and projects, breaking down complex concepts into manageable steps.



Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Gain basic understanding of basic components of programming language.	Cognitive	Understand
CO2: Understand any other programming language with the knowledge of array and string.	Cognitive	Understand
CO3: Apply function concepts in real time applications.	Cognitive	Apply
CO4: Analyse working of structure in c or other programming language programs.	Cognitive	Analyse
CO5: Students will be able to develop applications using C Programming	Cognitive	Apply

Learning Resources	
1.	Reference Books: "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie: "C Programming Absolute Beginner's Guide" by Greg Perry and Dean Miller:
2.	Journals & Periodicals: - ACM Transactions on Programming Languages and Systems - IEEE Transactions on Software Engineering
3.	Other Electronic Resources: https://www.gnu.org/software/libc/manual/ https://www.learn-c.org/



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks
Project/ Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project/Industrial.	30 marks
	Industry/ University mentor's feedback on the Project/ Industrial.	30 marks
	Attendance	10 marks
	Total	100 Marks

Mapping of PSOs & COs



	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	2	3
CO3	1	2	3
CO4	1	2	3
CO5	3	3	3

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	1	0	0	1	3	0	0	0	0	0	0	2
CO2	1	0	1	1	3	0	0	0	0	0	0	2
CO3	1	0	1	1	3	0	0	0	0	0	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	2	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE BTPY 105	COURSE NAME ENGINEERING PHYSICS	SEMESTER-1
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4



Course Pre-requisites	NIL
Course Category	Basic Science
Course focus	Skill Development
Rationale	Engineering physics combines the principles of physics and engineering, bridging the gap between theory and practical applications. It equips students with problem-solving skills, a deep understanding of scientific principles, and the ability to apply them to engineering challenges.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To familiarise with basics of Noise, Vibrations and Oscillations 2: To inculcate fundamental knowledge of Electromagnetism and its engineering applications 3: To develop basic understanding for different applications of optical phenomena 4: To embrace optical technologies and understand their functioning 5: To familiarise with introductory quantum physics and its importance



Course Content (Theory)	Weightage	Contact hours
Unit 1: Noise and Vibrations Theory: Concept of Noise and its sources. Noise Terminology. Definition of Harshness, acceptable levels and perception. Sources of Vibrations. Simple harmonic motion. Damped harmonic oscillator and its energy decay, Quality factor. Forced harmonic oscillator and its steady-state motion. Power absorbed by the oscillator. Resonance. Analogy between electrical and mechanical oscillations. Mathematical modeling of vibrations.	25%	12
Unit 2: Electromagnetism Theory: Laws of Electrostatics. Polarisation and corresponding classification of materials Magnetization and corresponding classification of materials, Permeability and susceptibility. Hysteresis Maxwell's equations. Continuity equation	20%	09
Unit 3: Modern Optics - I Theory: Superposition of waves and Interference. Concept of Diffraction and types of Diffraction. Fraunhofer diffraction of single and multiple slits. Types and applications of Diffraction gratings. Bragg's law.	20%	09
Unit 4: Modern Optics – II Theory: Concept of Polarization and types of Polarization. Polarization using reflection, double refraction, and scattering. Optical activity. Concept of Lasers, working and different types of Lasers, safety aspects, using lasers as sensors.	15%	07
Unit 5: Unit 5: Quantum Physics Theory: Black body radiation and concept of Photons, Photoelectric effect, de Broglie hypothesis, wave-particle duality, Interpretation of wave-function, Uncertainty relations, Schrodinger's wave-equation, Particle in a box.	20%	08



List Of Practical	Weightage	Contact hours
1: (1) To determine the frequency of vibrations on a string using Melde's experiment (2) To determine the frequency of the A.C. mains source using a Sonometer	20%	8
2: (3) To determine magnetic hysteresis Properties of ferromagnetic materials. (4) To find the horizontal component of earth's magnetic field using a tangent galvanometer (5) To determine the magnetic dipole moment of a bar magnet and horizontal intensity of a bar magnet and horizontal intensity of earth's magnetic field using a deflection magnetometer.	20%	6
3: (6) To determine the wavelength of Monochromatic source using diffraction gratings. (7) To determine the dispersive power of a grating. (8) To determine wavelength of light using Newton's rings setup. (9) To determine refractive index of liquids using Newton's Ring (Virtual Lab)	20%	8
4: (10) To determine the specific rotation of sugar using a polarimeter (using setup/virtual lab).	20%	4
5: (11) To determine Planck's constant using photoelectric effect setup. (12) To determine work function of the given material using photoelectric effect setup.	20%	4

Instructional Method and Pedagogy: The pedagogy should emphasize the integration of theory and practical applications, promote active learning through interactive discussions and collaborative projects, and provide opportunities for students to explore and analyze complex engineering systems.



Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:		
CO1: Understanding of the basic knowledge of harmonic motions.	Cognitive	Understand
CO2: Conceptualization of different electric and magnetic properties of materials	Cognitive	Analyze
CO3: Understanding different engineering applications of optical fundamentals.	Cognitive	Understand
CO4: Conceptualization of construction and working of lasers	Cognitive	Analyse
CO5: To embrace the concept of quantum physics and have a basic understanding of its principles.	Cognitive	Apply

Learning Resources	
1.	Reference Books: 1. Textbook of Engineering Physics by Dr. P. S. Aithal and Dr. H. J. Ravindra, ACME Learning 2. Engineering Physics by S K Nayak and K.P. Bhuvana, Tata McGraw-Hill Education.
2.	Journals & Periodicals: 1. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control 2. Journal of Magnetism and Magnetic Materials:
3.	Other Electronic Resources: 1. phet.colorado.edu 2. openstax.org



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks
Project/ Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project/Industrial.	30 marks
	Industry/ University mentor's feedback on the Project/ Industrial.	30 marks
	Attendance	10 marks
	Total	100 Marks

Mapping of PSOs & COs



	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	2	3
CO3	1	2	3
CO4	1	2	3
CO5	3	3	3

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	1	0	0	1	3	0	0	0	0	0	0	2
CO2	1	0	1	1	3	0	0	0	0	0	0	2
CO3	1	0	1	1	3	0	0	0	0	0	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	2	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTCS106	COURSE NAME ICT WORKSHOP	SEMESTER-1
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
0	2	0	2	0	2	0	1



Course Pre-requisites	NIL
Course Category	Engineering Science
Course focus	Skill Development
Rationale	The rationale for the ICT subject is to equip individuals with the necessary skills and knowledge to thrive in the digital age.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To aware students about the basics of computer hardware 2: To brief about troubleshooting and operating system 3: To provide an advanced knowledge about advanced functionalities of an Excel. 4: To give basic knowledge of Cyber Security. 5: To make students understand about various tools and technologies.



Course Content (Theory)	Weightage	Contact hours
Unit 1: Overview of Computer Hardware Introduction to hardware peripherals and its generations. Use and features of upgraded hardwares in recent computers/laptops. SMPS: Working, output connectors, UPS and Stabilizer Assembling and disassembling a computer.	20%	09
Unit 2: Troubleshooting and Operating System Hardware troubleshooting and repairing, Software troubleshooting and dealing with various error messages. Installation of operating system - windows and Linux . Multiple operating system installation in single system (Dual Boot). bootable mass storage devices	20%	09
Unit 3: Advanced Features of an Excel Advanced features of Excel/Google Sheet: Cell referencing, Hyperlink, Count and countif LOOKUP/VLOOKUP, Split cells, freeze panes, group and outline, Sorting, Conditional formatting, Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation	20%	09
Unit 4: Introduction of Tools & Technologies Introduction to Google Office Tools -Docs, Forms, slides, sites Introduction to Designing Tools, Latex , Online cloud platforms Introduction to AI , ML & DS Tools , IoT & Automation Tools	20%	09
Unit 5: Cyber Awareness Introduction to Cyber security Tools, Cyber Hygiene: viruses on the internet and installation of antivirus software. Customization of the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.	20%	09

List Of Practical	Weightage	Contact hours
1: Computer Assemble & Dissemble	20%	6
2: (1) Installation of Virtual Machine. (2) Installation of Operating System (Windows 10, 11 & Linux)	20%	6
3: (1) Auto fill out Invoice (2) Auto fill out Marksheet	20%	6
4: Make ICT workshop Google Slides PPT	20%	6
5: Installation of Security Tools.	20%	6

Instructional Method and Pedagogy: The instructional methods and pedagogies for teaching ICT involve a combination of theoretical knowledge and practical application.



Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:		
CO1: Upon completion of this laboratory course, students will be able to read and use a manufacturing drawing as a definition for the manufacturing of a part.	cognitive	Understand
CO2: Able to fabricate components with their own	cognitive	Analyze
CO3: Understand the practical difficulties encountered in industries during any assembly work.	cognitive	Understand
CO4: Will also get practical knowledge of the dimensional	cognitive	Apply
CO5: accuracies and dimensional tolerances possible with different manufacturing processes.	cognitive	Apply

Learning Resources	
1.	Reference Books: 1. Singh, D.K., Fundamentals of Manufacturing Engineering, Ane Books Pvt. Ltd, New Delhi, 2nd Edition, (2009). 2. Raghuwanshi, B.S., Course in Workshop Technology, Dhanpat Rai & Sons, New Delhi, (1991). 3. Schey, J.A., Introduction to Manufacturing Process, 3rd Edition, McGraw Hill, (2000).
2.	Journals & Periodicals: 1. Journal of Information Technology 2. ACM Transactions on Computer-Human Interaction 3. Journal of Computer-Mediated Communication"
3.	Other Electronic Resources: Online Professional Development Courses: Websites like LinkedIn Learning, Udemy, and Coursera offer online courses specifically designed for professional development in ICT.



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks
Project/ Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project/Industrial.	30 marks
	Industry/ University mentor's feedback on the Project/ Industrial.	30 marks
	Attendance	10 marks
	Total	100 Marks

Mapping of PSOs & COs



	PSO1	PSO2	PSO2
CO1	0	1	1
CO2	0	1	1
CO3	0	1	1
CO4	0	1	1
CO5	0	1	1

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	1	2	1	0	2	2	2	0	2	2	2	2
CO2	1	2	1	0	2	0	0	0	2	2	2	2
CO3	1	0	1	2	2	1	0	0	2	0	2	3
CO4	1	2	2	0	2	2	2	0	2	0	2	3
CO5	1	2	0	2	2	0	0	0	2	2	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE BTFS108	COURSE NAME FUNDAMENTALS OF FIRE, SAFETY, HEALTH & ENVIRONMENT	SEMESTER-1
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2



Course Pre-requisites	NIL
Course Category	Engineering Science
Course focus	Employability
Rationale	The rationale behind fire and environmental safety as a subject is to educate individuals and communities about the risks associated with fire and other environmental hazards, and to promote strategies and practices that minimize those risks.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: Understand the fire, safety, health and environment challenges in the built and industrial environment and approaches to addressing the same. 2: Become aware of important past incidents causing major loss of life & property and damage to environment, and their impact with respect to safety legislation and environment 3: History and current role of Fire & EHS related legislation and role of agencies involved with implementation 4: Understand approaches for addressing fire and EHS challenges in the industrial environment. 5: Become familiar with current fire & safety engineering and management concepts and practices followed in the industry



Course Content (Theory)	Weightage	Contact hours
Unit 1: Theory: Challenges to safety in built environment, types of hazards likely to cause harm (fire, burns, electric shock, falls), natural disasters, fatalities involving hazardous environments. Important Case studies involving major incidents and their subsequent effect on safety outlook. Approach to addressing Fire & EHS challenges at organization and national level.	20%	8
Unit 2: The concept of industrial safety, health and environment - need, nature and importance. Focus on Human resource, and the concept of importance of 'man' as central theme in safety. Concept of accident prevention, occupational health and environmental protection. Problems of Industrial safety, occupational health and environmental pollution & modern concept of SHE.	20%	05
Unit 3: History and role of building codes and safety legislation, concept of safety versus risk, enforcement of codes and standards, role of government agencies and emergency services in enforcing legislation, government framework and infrastructure involved in safety legislation enforcement. Role of code enforcement, plan review and approval, record keeping, public education	20%	04
Unit 4: Industrial Fire & Safety management concepts – hazard identification and risk assessment, risk reduction and control methods. Design aspects such as segregation and separation, fire resisting construction, emergency exit arrangements, access for emergency agencies, fire protection systems, safe operational practices, maintenance and upkeep of systems, planning for emergency response. Design approaches for fire and safety, NFPA fire safety concepts tree.	20%	05
Unit 5: Environmental Pollution Air Pollution Sources and effects of air pollution, NAAQS Basic principles of air pollution control devices Global effects of air pollution, Air Pollution due to automobiles, photochemical smog. Water Pollution: Sources and effects, Effluent standards Domestic and Industrial wastewater and treatment principles, Land pollution:- Solid waste, solid waste management by land filling, composting. Social Issues and the environment, from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns.	20%	08



Instructional Method and Pedagogy: The instructional method and pedagogy of the fire and safety subject typically involve a combination of theoretical knowledge, practical training, and hands-on exercises.

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:	Cognitive	Understand
CO1: Students will understand the fire and EHS challenges faced in the built and industrial environment, and the current approaches taken to address the same.	Cognitive	Learn
CO2: Students will learn about major incidents which affected industrial and societal attitude towards safety.	Cognitive	Familiar
CO3: Students will become familiar with the history and development of fire & safety legislation, their current form and role of different agencies involved in their implementation.	Cognitive	Analyze
CO4: Students will be able to explain the different design approaches for addressing the fire & life safety challenges in built and industrial environments	Cognitive	Apply
CO5: Students will become aware of the different engineering and management concepts applied for addressing fire and safety risks in industrial scenarios.	Cognitive	

Learning Resources	
1.	Reference Books: 1. Cheunisinoff Graffia, Environmental Health & Safety Management,. Reprint Jaico Publishing House. 2. Tarafdar, Industrial Safety Management
2.	Journals & Periodicals: 1. International Journal of Environmental Research and Public Health 2. Journal of Occupational and Environmental Hygiene
3.	Other Electronic Resources: OSHA, NFPA ,EPA Provides information on environmental regulations, guidelines, and resources.



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks
Project/ Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project/Industrial.	30 marks
	Industry/ University mentor's feedback on the Project/ Industrial.	30 marks
	Attendance	10 marks
	Total	100 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	2	1
CO3	1	1	0
CO4	1	2	0
CO5	0	2	0

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	0	1	3	2	2	2	2	1	1	2
CO2	1	3	2	3	2	2	1	1	2	1	2	2
CO3	3	1	0	1	3	2	2	1	2	1	1	2
CO4	3	1	0	1	3	2	2	1	2	1	2	2
CO5	3	1	0	1	3	2	2	1	2	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Teaching Scheme

Semester – II

Sr. No	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTME203	Engineering Graphics	0	4	0	4	0	0	2	2	-	-	-	-	50	50
2	BTMA203	Mathematics - II	3	0	1	4	3	1	0	4	20	40	40	100	-	100
3	BTME204	Engineering Mechanics	4	2	0	6	4	0	2	5	20	40	40	100	50	150
4	BTCY205	Engineering Chemistry	3	2	0	5	3	0	2	4	20	40	40	100	50	150
5	BTCS206	Python Programming	3	0	2	5	3	0	2	4	20	40	40	100	50	50
7	BTFS108	Industrial Internship	0	0	2	2	0	0	0	2	-	-	-	-	100	100
8	VACC201	Tinkering & Mentoring*	0	2	0	2	0	2	0	1	-	-	-	-	50	50
Total						26				22						700

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

* syllabus attached after semester 8 teaching scheme



COURSE CODE BTTME202	COURSE NAME Engineering Graphics	SEMESTER II
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
0	4	0	4	0	4	0	2

Course Pre-requisites	Higher Secondary School Certificate
Course Category	Engineering Science
Course focus	Skill Development
Rationale	Engineering graphics serve as a universal language that enables engineers, designers, and technicians to effectively communicate and exchange information. By using standardized symbols, dimensions, and graphical representations, technical drawings can convey complex ideas and specifications in a concise and precise manner. This helps to eliminate ambiguity and ensures that all stakeholders involved in a project have a clear understanding of the design intent. Engineering graphics provide a visual representation of engineering concepts and designs. It allows engineers to create 2D and 3D drawings that depict the physical appearance, dimensions, and relationships of various components and systems. Visualization aids in understanding the spatial relationships, proportions, and functionality of the design before it is actually built. This helps engineers identify potential issues, make improvements, and optimize the design for performance, manufacturability, and aesthetics. Engineering graphics facilitate the analysis and evaluation of designs. By creating drawings that represent different views, sections, and projections of a design, engineers can assess its structural integrity, functionality, and performance.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: Understand the standards and common cases as well as dimensioning in technical drawings development 2: Able to develop multi-aspect sketches, sectional views and geometries of the development of design projects 3: Visualize objects in all dimensions and learn displaying techniques



for graphical communication in design process.

List Of Practical	Weightage	Contact hours
1. Introduction of dimensioning methods, various scales, different types of line, construction of different polygon, etc.	10%	3
2: Solve problems on dimensioning methods, various scales, etc. And draw them on A2 size drawing sheet	10%	3
3: Solve problems on conic section and draw them on A2 size drawing sheet	10%	3
4: Solve problems on engineering curves and draw them on A2 size drawing sheet	10%	3
5: Solve problems on Projection of line and draw them on A2 size drawing sheet	5%	2
6: Solve problems on Projection of solid and draw them on A2 size drawing sheet	10%	3
7: Solve problems on Projection of plane and draw them on A2 size drawing sheet	10%	3
8: Solve problems on Development of surface and draw them on A2 size drawing sheet	10%	3
9: Solve problems on Orthographic projection and draw them on A2 size drawing sheet	10%	3
10: Solve problems on Isometric projection and draw them on A2 size drawing sheet	15%	4

Instructional Method and Pedagogy: Chalk board, PPT, Hands on training

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand the projections of points and lines, planes, solids and section of solids CO2: Understand the dimensions, units, and annotate 2D & 3D engineering drawings CO3: Apply Loci of points and engineering curves in the field of engineering CO4: Develop lateral surfaces and apply the same in engineering drawing. CO5: Create orthographic projections into isometric projections and vice versa for complicated geometries.	Cognitive	Understand Understand Apply Develop Create



Learning Resources														
1.	Reference Books: Style: name of the authors, title, publisher, city of publication and year of publication.													
	1. T. Jeyapoovan, “Engineering Drawing & Graphics using Auto CAD 2000”, Vikas Publishing House Pvt. Ltd., New Delhi 2. P.S. Gill, “A textbook of Engineering Drawing”, S.K. Kataria& sons, Delhi. 3. D.A. Jolhe, “Engineering Drawing with an Introduction to Auto CAD”, Tata McGraw- Hill Publishing Co. Ltd., New Delhi. 4. R.K. Dhawan, “A textbook of Engineering Drawing”, S. Chand& Company Ltd., New Delhi. 5. N. D. Bhatt, “Engineering drawing”, Charottar publication. 6. P.J. Shah, “A Textbook of Engineering Graphics”, S. Chand& Company Ltd													
2.	Journals & Periodicals:													
3.	Other Electronic Resources: 1. https://nptel.ac.in/courses/112103019/ 2. https://www.udemy.com/course/ed/													
Evaluation Scheme		Total Marks												
Theory: Mid semester Marks		20 marks												
Theory: End Semester Marks		40 marks												
Theory: Continuous Evaluation Component Marks		<table><tr><td>Attendance</td><td>05 marks</td></tr><tr><td>MCQs</td><td>10 marks</td></tr><tr><td>Open Book Assignment</td><td>15 marks</td></tr><tr><td>Article Review</td><td>10 marks</td></tr><tr><td>Total</td><td>40 Marks</td></tr></table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks		
Attendance	05 marks													
MCQs	10 marks													
Open Book Assignment	15 marks													
Article Review	10 marks													
Total	40 Marks													
Practical Marks		<table><tr><td>Attendance</td><td>05 marks</td></tr><tr><td>Practical Exam</td><td>20 marks</td></tr><tr><td>Viva</td><td>10 marks</td></tr><tr><td>Journal</td><td>10 marks</td></tr><tr><td>Discipline</td><td>05 marks</td></tr><tr><td>Total</td><td>50 Marks</td></tr></table>	Attendance	05 marks	Practical Exam	20 marks	Viva	10 marks	Journal	10 marks	Discipline	05 marks	Total	50 Marks
Attendance	05 marks													
Practical Exam	20 marks													
Viva	10 marks													
Journal	10 marks													
Discipline	05 marks													
Total	50 Marks													



Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	0
CO2	1	1	1	0
CO3	1	1	2	0
CO4	1	2	1	0
CO5	3	3	3	0
Avg.	1	2	2	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	3	0	0	0	0	1	0	1
CO2	1	0	1	1	3	0	0	0	0	1	0	1
CO3	1	0	1	1	3	0	0	0	0	1	0	1
CO4	1	0	2	1	3	0	0	0	2	1	0	1
CO5	1	2	3	1	3	0	1	0	3	1	0	1
Avg.	1	0	1	1	3	0	0	0	1	1	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTMA203				COURSE NAME Mathematics - II				SEMESTER II			
Teaching Scheme (Hours)				Teaching Credit							
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit				
3	0	1	4	3	0	1	4				

Course Pre-requisites	Mathematics- I
Course Category	Basic Science
Course focus	Skill Development
Rationale	Mathematics-II is a fundamental discipline that plays a crucial role in various fields of study and practical applications. Mathematics - II often delves deeper into the principles of calculus, including differentiation and integration techniques. This allows students to develop a more thorough understanding of



	functions, limits, derivatives, and integrals. Advanced calculus is vital in various scientific and engineering disciplines, such as physics, chemistry, economics, and computer science. Linear algebra is a branch of mathematics that focuses on vector spaces, matrices, and systems of linear equations. It provides powerful tools for solving problems involving multiple variables and equations. Linear algebra finds applications in areas such as computer graphics, data analysis, optimization, and cryptography. Differential equations are equations that involve derivatives of an unknown function. They are used to describe a wide range of phenomena, from population growth to fluid dynamics. Mathematics - II often introduces students to the theory and methods of solving ordinary differential equations. This knowledge is crucial in various scientific and engineering disciplines, such as physics, biology, electrical engineering, and control systems.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: Understand the terminologies of basic probability, two types of random variables and their probability functions observe and analyze the behaviour of various discrete and continuous probability distributions 2: Understand the central tendency, correlation and correlation coefficient and also regression 3: Apply the statistics for testing the significance of the given large and small sample data and use time series analysis for predictions

Course Content (Theory)	Weightage	Contact hours
Unit 1: First ordered odes: Exact equations, Integrating factors, Linear and Bernoulli's equation, Homogeneous equation, Applications of first order equations Orthogonal trajectories, Mixture problem, and Temperature problem.	20%	8
Unit 2: Higher ordered Linear odes with constant coefficients, Wronskians Differential operators, Method of solving homogeneous equations, non-homogeneous equations, Inverse operators, Methods of solving non-homogeneous equations. Cauchy- Euler equations, Method of undetermined coefficients, Method of variation of parameters	20%	10



Unit 3: Laplace and Inverse Laplace transforms, shifting theorems, Convolution theorem, Laplace transform of Derivative and Integration. Solution of linear ODE's using Laplace transform. Initial and boundary value problems, Applications of Laplace transforms: Solution of Heat, Wave and Laplace's equations.	20%	10
Unit 4: Double and Triple integration, change of order of double integration, double integration in Polar form, Jacobians and change of variables formula. Applications to find area and volume.	20%	10
Unit 5: Vector valued functions, gradient and directional derivatives, Divergence and curl, Vector identities. Line Integral and Green's Theorem.	20%	7

Instructional Method and Pedagogy: (Max. 100 words)

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Identify and solve some ordinary differential equations CO2: Apply basic knowledge of mathematics to solve real world problems. CO3: Analyze and solve engineering problems using Laplace Series. CO4: Apply the necessary Laplace transform techniques to solve second-order ordinary differential equations involving the Dirac delta (or unit impulse).	Cognitive	Identify Apply Analyze Apply

Learning Resources

1.	Reference Books:. 1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. 2. Kreyszig, E., Advanced Engineering Mathematics, 8th Edition, Wiley & Sons, (1999). 3. Anton, H., Elementary Linear Algebra with Applications, 8th Edition, John Wiley & Sons, (1995).
2.	Journals & Periodicals:
3.	Other Electronic Resources:



Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Article Review	10 marks										
Total	40 Marks										

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	0	3	0
CO2	1	0	3	0
CO3	1	0	3	0
CO4	0	0	0	0
CO5	0	0	0	0
Avg.	1	0	3	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	3	0	0	0	1	0	1	0	1
CO2	1	2	1	1	0	0	0	1	0	1	0	1
CO3	3	0	1	2	0	0	0	1	0	1	0	1
CO4	2	1	1	3	0	0	0	1	0	1	0	1
CO5	1	2	1	1	0	0	0	1	0	1	0	1
Avg.	2	1	1	2	0	0	0	1	0	1	0	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE BTME204	COURSE NAME Engineering Mechanics	SEMESTER II
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
4	2	0	6	4	2	0	5

Course Pre-requisites	Engineering Physics
Course Category	Engineering Science
Course focus	Skill Development
Rationale	Engineering Mechanics allows engineers to analyze the equilibrium of structures and systems. This is important in determining the stability and safety of buildings, bridges, and other structures. By applying the principles of static equilibrium, engineers can calculate forces, moments, and stresses acting on different components and ensure that they are within safe limits. Engineering Mechanics provides a framework for understanding the behavior of objects subjected to external forces. It helps engineers analyze and predict how structures and machines will respond to different loads and operating conditions. By studying forces, motion, and their interactions, engineers can design mechanisms, machines, and systems that function properly and efficiently. Engineering Mechanics plays a crucial role in the design and optimization of engineering systems. Engineering Mechanics enables engineers to assess the safety and reliability of structures and systems. By understanding the behavior of materials and structures under different loading conditions, engineers can identify potential failure modes and assess the associated risks.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: Apply scalar and vector analytical determinate/indeterminate structures. 2: Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems. 3: Apply basic knowledge of mathematics and physics to solve real-world problems 4 : Application of established engineering methods to complex engineering problem solving. 5: Application of systematic engineering synthesis and design processes.



Course Content (Theory)	Weightage	Contact hours
Unit 1: Rigid Body Statics: Vector algebra, force systems, moment of a force about a point and about an axis; simplest equivalent forces and moment; free body diagram; force equilibrium, equations of equilibrium; problems in two and three dimensions. Types of loading supports and reactions; evaluating internal forces in bodies; axial force, Basic of shear force and bending moment. Planar Trusses and frames: static indeterminacy, analysis by method of joints and method of sections	30%	15
Unit 2: Centre of Gravity : Centroid of lines, plane areas and volumes, Examples related to centroid of composite geometry	15%	10
Unit 3: Moment of Inertia Theory: First and second moment of area and mass, radius of gyration, parallel axis theorem, product of inertia, rotation of axes and principal M.I., Thin plates, M.I. by direct method (integration), composite bodies.	20%	10
Unit 4: friction theory: Types and laws of friction, impending motion problems involving large and small contact surfaces: wedge friction, ladder friction	10%	10
Unit 5: Dynamics Theory: Kinematics and Kinetics of particles: Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables. Dynamics of rigid bodies: Newton's laws, Chasle's Theorem; D' Alembert's Principal, Work & Energy and Impulse Momentum methods, Impact.	25%	15

List Of Practical	Weightage	Contact hours
1. Justify law of parallelogram of forces for a coplanar concurrent force system in equilibrium.	10%	3
2. Justify law of polygon of forces for a coplanar concurrent force system in equilibrium.	10%	3
3. Calculate the magnitude and nature of forces in members of the jib-crane.	10%	3
4. Verify lemi's theorem.	10%	3
5. Verify the principle of moment using bell crank lever.	10%	4
6. Verify the support reactions and verify the condition of equilibrium for a simply supported beam at ends.	10%	3
7. Calculate Mass moment of inertia of a fly wheel.	15%	3
8. Determine the co-efficient of static friction between 1. glass and wood; 2. wood and cloth; and 3. wood and metal. (Horizontal surface)	15%	4



9. Determine the co-efficient of static friction between 1. glass and wood; 2. wood and cloth; and 3. wood and metal. (Inclined surface)	10%	4
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Instructional Method and Pedagogy: (Max. 100 words)

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Apply systematic engineering synthesis and design processes CO2: Understand theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. CO3: Understand specialist bodies of knowledge within the engineering discipline. CO4: Apply established engineering methods to complex engineering problem solving. CO5: Evaluate the beam related problems		

Learning Resources

1.	Reference Books: Style: name of the authors, title, publisher, city of publication and year of publication. - Shames, I.H., Rao, G.K.M., Engineering Mechanics – Statics and Dynamics, Pearson 's Education, (2006). - Desai and Mistry, "Engineering Mechanics", Popular Prakashan - Beer, F.P., Johnston, E.R., Vector Mechanics for Engineers, Vol. 1 - Statics, Vol. 2, Dynamics, 9thEdition, Tata McGraw Hill, (2011). - Meriam, J.L., Kraige, L.G., Engineering Mechanics, Vol. I Statics, Vol. 2 Dynamics, 6thEdition, John Wiley, (2008). - Timoshenko, S., Young, D.H., Engineering Mechanics, McGraw Hill Inc., (1940).
2.	Journals & Periodicals:
3.	Other Electronic Resources: https://nptel.ac.in/courses/112103109/ https://swayam.gov.in/courses/5241-engineering-mechanics


 3. <https://www.edx.org/course/engineering-mechanics-2>

Evaluation Scheme	Total Marks												
Theory: Mid semester Marks	20 marks												
Theory: End Semester Marks	40 marks												
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks		
Attendance	05 marks												
MCQs	10 marks												
Open Book Assignment	15 marks												
Article Review	10 marks												
Total	40 Marks												
Practical Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>Practical Exam</td><td>20 marks</td></tr> <tr> <td>Viva</td><td>10 marks</td></tr> <tr> <td>Journal</td><td>10 marks</td></tr> <tr> <td>Discipline</td><td>05 marks</td></tr> <tr> <td>Total</td><td>50 Marks</td></tr> </table>	Attendance	05 marks	Practical Exam	20 marks	Viva	10 marks	Journal	10 marks	Discipline	05 marks	Total	50 Marks
Attendance	05 marks												
Practical Exam	20 marks												
Viva	10 marks												
Journal	10 marks												
Discipline	05 marks												
Total	50 Marks												

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	0
CO2	2	3	1	0
CO3	1	2	1	0
CO4	2	1	1	0
CO5	1	1	3	0
Avg.	2	2	2	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs



	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	0	0	0	0	0	1	1	2
CO2	3	1	0	2	0	0	0	0	0	1	1	1
CO3	3	2	1	1	0	0	0	0	0	2	1	3
CO4	3	0	0	1	0	0	0	0	0	0	1	2
CO5	3	1	3	1	0	0	0	0	0	2	1	2
Avg.	3	1	1	1	0	0	0	0	0	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTCY205	COURSE NAME Engineering Chemistry	SEMESTER II
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	Higher Secondary School Certificate
Course Category	Basic Science
Course focus	Skill Development
Rationale	Understanding of Chemical Principles: Chemistry forms the basis of many engineering disciplines, such as materials science, environmental engineering, chemical engineering, and bioengineering. Engineering Chemistry provides engineers with the knowledge to select appropriate materials for specific applications. Engineers need to understand the chemical properties of materials, such as metals, polymers, ceramics, and composites, to ensure their suitability for various engineering projects. As environmental concerns become increasingly important, engineers are expected to develop sustainable solutions. Engineering Chemistry equips engineers with the understanding of chemical processes and their impact on the environment. Engineering projects often involve handling hazardous materials and chemical reactions. Understanding the properties of chemicals, their reactivity, and potential hazards is crucial for engineers to ensure the safety of personnel and the surrounding environment.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To impart sound knowledge in the different fields of theoretical chemistry so as to apply it to the problems in the engineering field. 2: To Understand hardness of water, its analysis and treatment along



	with its calculation 3: To Understand corrosion, various types and its prevention techniques 4 : To Understand about fuels, its analysis, combustion and calculation 5: To Understand lubrication and its property determination, also to learn various instrumental techniques in Chemical analysis
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Course Content (Theory)	Weightage	Contact hours
Unit 1: Water Technology: Chemistry of water, Types of impurities in water, Types of hardness, Units of hardness, Estimation of hardness-EDTA method, Disadvantages of using hard water for industrial purpose. Scale and sludge formation in boiler, Caustic Embrittlement- Priming and foaming. Softening of water: Ion exchange process, Lime soda process (with numerical), Zeolite process- Desalination. Reverse osmosis. Drinking water and its characteristics. Numerical to calculate hardness of water	20%	9
Unit 2: Corrosion, Control and Prevention: Introduction, Corrosion problems, Types of corrosion: Chemical corrosion- Pilling Bed worth Rule and Electrochemical corrosion. Theory of corrosion pitting corrosion, crevice corrosion, waterline corrosion. Factors affecting corrosion, Corrosion control methods, Corrosion inhibitors. Protective Coatings: Metallic coatings – Galvanizing, Tinning and electroplating – Non-metallic coatings –Chromate coating and Anodizing. Powder coating – methods of application and advantages.	20%	9
Unit 3: Fuels & Combustion: Fossil fuels & classification, Calorific value & its types, Determination of calorific value by Bomb calorimeter, Proximate and Ultimate analysis of coal and their significance, calculation of calorific value by Dulong's formula. Knocking, relationship between' knocking & structure of hydrocarbon. Octane number, Cetane number, combustion and it related numerical problems.	20%	9
Unit 4: Lubricants: Introduction, Mechanism of lubrication, Classification of lubricants, significance & determination of Viscosity, Viscosity Index, Flash & Fire Points, Cloud & Pour Points, Carbon Residue, Aniline Point, Acid Number, Saponification Number.	20%	9
Unit 5: Instrumental Techniques in Chemical Analysis: Lambert's and Beer's Law and its applications, Introduction, Principle, Instrumentation and applications of IR & UV spectroscopy, Gas Chromatography & its applications.	20%	9

List Of Practical	Weightage	Contact
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		hours
1. To estimate the amount of total hardness present in the given sample of water by EDTA method.	20%	4
2. To Measure the pH value of given solutions.	10%	4
3. To determine alkalinity of given water sample.	10%	3
4. To determine the acidity of the given water sample	10%	3
5. To measure a rate of corrosion of Iron in different medium.	10%	4
6. To measure viscosity of a given sample.	10%	4
7. To determine flash point and fire point of a given sample.	15%	4
8. To determine cloud point and pour point of a given sample.	15%	4

Instructional Method and Pedagogy: Chalk board, PPT, Activity

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Students would be Understand the use of all equipment's pertaining to mentioned topics. CO2: Students would be able to Understand the problems in the engineering field related to chemical aspects. CO3: Students would be able to analyze the results of quality of water, and other material. CO4: students would be Understand Engineering materials with properties that find various engineering applications	Cognitive	Understand Understand Analyze Understand

Learning Resources

1.	Reference Books: Style: name of the authors, title, publisher, city of publication and year of publication. 1. Engineering Chemistry, P.C. Jain, Dhanpat Rai Pub. Co. 2. Engineering Chemistry, S. S. Dara, S. Chand Pub. New Delhi 3. Engineering Chemistry, R. Gopalan 4. Wiley's Engineering Chemistry, Multiple Authors, Wiley International
2.	Journals & Periodicals: 1. Journal of Chemical Technology, 2. Environmental Science and Technology,



	3. Chemical Engineering Science, 4. Energy and Fuels
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1
CO2	2	3	1	2
CO3	1	2	1	1
CO4	2	1	1	1
CO5	1	1	3	1
Avg.	2	2	2	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	0	0	0	0	0	1	1	2
CO2	3	1	0	2	0	0	0	0	0	1	1	1
CO3	3	2	1	1	0	0	0	0	0	2	1	3
CO4	3	0	0	1	0	0	0	0	0	0	1	2
CO5	3	1	3	1	0	0	0	0	0	2	1	2
Avg.	3	1	1	1	0	0	0	0	0	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE	COURSE NAME	SEMESTER
BTCS206	Computer Programming-II	II

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
0	2	0	2	0	2	0	1

Course Pre-requisites	Computer Programming I
Course Category	Engineering Science
Course focus	Skill Development
Rationale	Computer Programming-II serves as a platform to reinforce the fundamental concepts learned in the introductory course. By revisiting these concepts, students can solidify their understanding and build a strong foundation for advanced programming topics. The course introduces students to more advanced programming topics that were not covered in the introductory course. This includes more complex data structures, algorithms, object-oriented programming, and other advanced programming paradigms. Computer Programming-II focuses on applying programming concepts to real-world problems. Through practical assignments and projects, students develop their problem-solving skills and gain hands-on experience in solving complex programming challenges. This practical application helps students bridge the gap between theory and practice. The course emphasizes the importance of software engineering principles and practices. Students learn about software design principles, code organization, documentation, debugging techniques, and testing methodologies. These



	skills are vital for producing high-quality, maintainable, and scalable software solutions.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: Identify /characterize/define a problem 2: Design a program to solve the problem 3: Create executable code 4: Read most Python code 5: Write basic unit tests

List Of Practical	Weightage	Contact hours
Unit-1 : 1. Compute the GCD of two numbers. 2. Find the square root of a number (Newton's method) 3. Exponentiation (power of a number)	20%	6
Unit-2 : 1. Find the maximum of a list of numbers 2. Linear search and Binary search 3. Selection sort, Insertion sort	20%	6
Unit 3: Practical: 1. Merge sorting of numbers 2. Find First n prime numbers 3. Create Multiply matrices	20%	6
Unit 4: 1. Programs that take command line arguments (word count) 2. Find the most frequent words in a text read from a file 3. Simulate elliptical orbits in Pygame	20%	6
Unit 5 1. Simulate bouncing ball using Pygame 2. Student group mini project	20%	6

Instructional Method and Pedagogy: PPT, Whiteboard, Tutorial

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
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After successful completion of the above course, students will be able to: CO1: To Identify /characterize/define a problem. CO2: To Design a program to solve the problem CO3: To Create executable code. CO4 : To Understand about how to Read most Python code. CO5: To Understand about how to Write basic unit tests	Cognitive	Identify Design Create Understand Understand
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Learning Resources

1.	Reference Books: Style: name of the authors, title, publisher, city of publication and year of publication. 1. Head-First Python (2nd edition), Paul Barru, OREILLY Publication
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	0
CO2	2	3	1	0
CO3	1	2	1	0
CO4	2	1	1	0
CO5	1	1	3	0



Avg.	2	2	2	0
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1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	0	0	0	0	0	1	1	2
CO2	3	1	0	2	0	0	0	0	0	1	1	1
CO3	3	2	1	1	0	0	0	0	0	2	1	3
CO4	3	0	0	1	0	0	0	0	0	0	1	2
CO5	3	1	3	1	0	0	0	0	0	2	1	2
Avg.	3	1	1	1	0	0	0	0	0	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTME207	COURSE NAME Computer Aided Drawing	SEMESTER II
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
0	2	0	2	0	2	0	1

Course Pre-requisites	Computer Programming I
Course Category	Engineering Science
Course focus	Skill Development
Rationale	Computer-aided drawing (CAD) is a technology that has revolutionized the field of design and drafting. CAD software provides tools and features that streamline the design process, allowing designers to create and modify drawings quickly and easily. It eliminates the need for manual drafting tools such as pencils, rulers, and erasers, reducing the time and effort required to produce accurate drawings. CAD systems enable precise and accurate measurements, alignments, and geometries in drawings. They provide a high level of control over elements such as line thickness, color, and text placement. CAD software allows designers to create 3D models of their designs, enabling better visualization of the final product or structure.
Course Revision/ Approval	5 th March 2024



Date:	
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To Understand the standards and common cases as well as dimensioning in technical drawings development. 2: To Ability to manipulate drawings through editing and plotting techniques 3: To Visualize objects in all dimensions and learn displaying techniques for graphical communication in design process. 4 : To Become familiar with Solid Modelling concepts and techniques.

List Of Practical	Weightage	Contact hours
Unit-1 : : Introduction to Auto CAD: Theory: Starting with Auto CAD, AutoCAD dialog boxes, Co-ordinate Systems, drawing lines, circle, arcs, rectangle, ellipse, polygons, etc. [Exercises] Practical: Introduction to Auto CAD.	20%	6
Unit-2 : Editing sketched objects Theory: Editing sketches, moving, copying, pasting, offsetting, scaling, chamfering, trimming, mirroring. Filletting, sketched objects. [Exercises] Practical: Perform various editing operations in AutoCAD.	20%	6
Unit 3: Basic dimensioning: Theory: Geometric dimensioning and Tolerance: Dimensioning AutoCAD, creating linear, rotated, angular aligned base line Dimensions, Modifying dimensions. Practical: Apply various dimensioning methods to a machine component in AutoCAD.	20%	6
Unit 4: Theory: Plotting the drawings in AutoCAD, plotting drawing using the plot dialog box, adding plotters and using plot styles, plotting sheets. Practical: Perform various plotting operations in AutoCAD.	20%	6
Unit 5 : Basics of 3D Modelling: Theory: Generation of Primitive Solids, Boolean Operations, Region, Boundary Layer operations, Extrude, Subtract, Union, Explode, Exercises, Exercises Practical: Perform 3D Modelling in AutoCAD.	20%	6

Instructional Method and Pedagogy: PPT, Whiteboard, Tutorial

Course Objectives:	Blooms'	Blooms'
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	Taxonomy Domain	Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: To Understand the basic commands of AutoCAD software.. CO2: To Understand the concept of Computer Aided Drafting using AutoCAD software. CO3: To Apply basic concepts to develop construction (drawing) techniques CO4 : To Apply basic concepts of the AutoCAD software CO5: To Understand and demonstrate dimensioning concepts and techniques	Cognitive	Understand Understand Apply Apply Understand

Learning Resources

1.	Reference Books: Style: name of the authors, title, publisher, city of publication and year of publication. 1. Sham Tickoo et. al., “AutoCAD 2012 for engineering and designers” Dream tech press, New Delhi 2. Finkelstein Ellen et. al., “AutoCAD 2012 and AutoCAD LT 2012 Bible” Wiley India, New Delhi
2.	Journals & Periodicals:
3.	Other Electronic Resources: 1. https://www.udemy.com/topic/autocad/ 2. https://www.autodesk.com/training 3. https://www.coursera.org/autodesk

Evaluation Scheme	Total Marks												
Practical Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>Practical Exam</td><td>20 marks</td></tr> <tr> <td>Viva</td><td>10 marks</td></tr> <tr> <td>Journal</td><td>10 marks</td></tr> <tr> <td>Discipline</td><td>05 marks</td></tr> <tr> <td>Total</td><td>50 Marks</td></tr> </table>	Attendance	05 marks	Practical Exam	20 marks	Viva	10 marks	Journal	10 marks	Discipline	05 marks	Total	50 Marks
Attendance	05 marks												
Practical Exam	20 marks												
Viva	10 marks												
Journal	10 marks												
Discipline	05 marks												
Total	50 Marks												



Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1
CO2	1	1	1	1
CO3	1	1	1	1
CO4	1	1	1	1
CO5	1	1	1	1
Avg.	1	1	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	0	0	0	0	0	0	0
CO2	3	2	3	3	2	0	0	0	0	0	0	0
CO3	3	2	3	3	2	0	0	0	0	0	0	0
CO4	3	2	3	3	2	0	0	0	0	0	0	0
CO5	3	2	3	3	2	0	0	0	0	0	0	0
Avg.	3	2	3	3	2	0	0	0	0	0	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE AECC201	COURSE NAME Communication Skills in English	SEMESTER II
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2

Course Pre-requisites	Basic English Grammar & Intermediate communication skills
Course Category	Ability Enhancement Compulsory Course
Course focus	Employability and Skill Development
Rationale	English is the most widely spoken language around the world. It serves as a lingua franca in international settings, allowing individuals from diverse cultural backgrounds to communicate and collaborate effectively. By mastering English communication skills, you gain access to a global platform for sharing ideas, establishing connections, and participating in global conversations. English proficiency is crucial for academic pursuits, particularly in higher education. Many universities and academic institutions use English as the medium of instruction.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To enable learners develop their basic communication skills in English. 2: To equip them with writing skills needed for academic as well as workplace context. 3: To prepare students for professional communication at world level. 4: To develop corporate communicational attitude. 5: To strengthen digital communication using technological modules and expertise.

Course Content (Theory)	Weightage	Contact
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	e	t hours
Unit 1: Communicative Skills Basics of Communication, Verbal & Non-verbal Communication, Barriers to Effective Communication, Strategies of Effective Communication	20%	06
Unit 2: : Grammar & Vocabulary Types of sentences, Synonyms, Antonyms, Tenses - Past, Present & Future, Homophones, Modals, Verb forms, Phrasal Verbs, Error correction, commonly misused words, Technical term.	20%	06
Unit 3: Listening & Reading Skills Definitions (Listening & Reading), Types of Listening, Barriers to Effective Listening, Traits of a Good Listener, Types of Reading, Techniques of Effective Reading, Reading Tasks (Critical & Inferential).	20%	06
Unit 4: : Writing Skills & Speaking Skills Letter writing - Complaint & Leave, Article, Precise writing, Report writing, Note taking and Note making, Creative Writing Introducing self, Interview Skills, Public Speaking, Debates, Role plays, Group Discussion.	20%	06
Unit 5: ICT/ Digital/ E-Skills Computer Assisted Language Learning (CALL), Mobile Assisted Language Learning (MALL), Emails, Blogs, Digital/ E-Portfolio, Filling Online Application Forms	20%	06

Instructional Method and Pedagogy: PPT, Audio/Video Presentation, Group Discussion

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: To enable learners develop their basic communication skills in English. CO2: To equip them with writing skills needed for academic as well as workplace context. CO3: To prepare students for professional communication at world level. CO4: To develop corporate communicational attitude. CO5: To strengthen digital communication using technological modules and expertise.	Cognitive	Understand Evaluate Apply Create Apply



Learning Resources	
1.	Reference Books: ➤ horpe, Edgar and Showick Thorpe “Basic Vocabulary” Pearson Education India, 2012. ➤ Green, David. “Contemporary English Grammar Structures and Composition” MacMillan Publishers, New Delhi, 2010. ➤ Wren & Martin (2001), English Grammar & Composition, New York. ➤ Mudambadithaya G.S., (2002) English Grammar and composition. ➤ Lupton, Mary Jane (1998). Maya Angelou: A Critical Companion. Westport: Greenwood Press. ISBN 978-0-313-303225. ➤ Booher, Diana. (2004), Booher’s Rules of Business Grammar, OUPUr, Penny, (2002), Grammar Practice Activities, OUP
2.	Textbook: ➤ Murphy, Raymond “Murphy’s English Grammar with CD” Cambridge University Press, 2004
3	Journals & Periodicals ➤ The Journal’ Basic English Grammar ➤ Fluent U’ English Language and Cultural Journal ➤ The Journal of English Academics’ ➤ Elsevier’ The research on language ➤ Index Noedicus : A Cumulative Index to English Language Periodicals ➤ The Illustrated English Language Periodicals
4	Other Electronic Resources ➤ Wordsworth - Language software

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks



Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1
CO5	1	1	1
Avg.	1	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	0	0	0	0	0	0	0
CO2	3	3	3	3	2	0	0	0	0	0	0	0
CO3	3	2	3	3	2	0	0	0	0	0	0	0
CO4	3	1	3	3	3	0	0	0	0	0	0	0
CO5	3	2	2	3	2	0	0	0	0	0	0	0
Avg.	3	2	2	3	2	0	0	0	0	0	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



Teaching Scheme

Semester –III

Sr. No	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTMA301	Mathematics III	3	0	1	4	3	0	1	4	20	40	40	100	-	100
2.	BTFS311	Safety Management I	3	0	0	3	3	0	0	3	20	40	40	100	-	100
3.	BTFS312	Legislations related to Fire & EHS	3	0	0	3	3	0	0	3	20	40	40	100	-	100
4.	BTFS313	Town Planning & Building Design	3	2	0	5	3	0	2	4	20	40	40	100	50	150
5.	BTFS314	Strength of Materials	3	2	0	5	3	2	0	4	20	40	40	100	50	150
6.	BTFS315	Machine Design & Industrial Drafting	4	2	0	6	4	2	0	5	20	40	40	100	50	150
7.	BTFS316	Fire drills & Practical	0	0	4	4	0	0	4	2	-	-	-	-	50	50
8.	AECC301	Entrepreneurship Development	2	0	0	2	2	0	0	2	20	40	40	100	-	100
9.	BTFS317	Industrial Internship	0	2	0	2	0	2	0	2	-	-	-	-	100	100
		Total				34				29						1000

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester



COURSE CODE BTMA301	COURSE NAME Mathematics - III	SEMESTER III
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	1	4	3	0	1	4

Course Pre-requisites	Mathematics II
Course Category	Basic Science
Course focus	Skill Development
Rationale	Mathematics-III introduces students to a wide range of advanced mathematical techniques and tools that are crucial for understanding and solving complex problems. These techniques include advanced calculus, differential equations, linear algebra, numerical methods, and complex analysis. Mastery of these techniques equips students with the necessary mathematical skills to analyze and solve problems encountered in their respective fields. Mathematics-III plays a vital role in the applications of science and engineering. It provides students with the mathematical foundation necessary to model and analyze real-world phenomena. Mathematics-III emphasizes problem-solving and analytical thinking skills. Through challenging mathematical problems and exercises, students learn to think critically and develop logical reasoning abilities.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To Compute some real improper integrals using techniques of complex functions 2: To Solve linear ordinary differential equations by using series expansion around regular and singular points. 3: To Work with complex valued functions. 4: To Expand one variable functions in series for example in Fourier series, Bessel series, Legendre series. 5: To Solve some most important partial differential equations occurring in engineering applications by the method of Separation of variables and the use of Fourier series.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Complex Analysis: Complex number, polar form and triangle inequality. Function of a complex variable, Elementary functions, Definition and properties of analytics functions Cauchy-Riemann equations, Cauchy's	20%	10



integral theorem and its applications. Review of Power series; Taylor series and Laurent expansions; Regular and irregular singular points Residues and the Cauchy residue formula; Evaluation of improper integrals.		
Unit 2: Partial Differential Equations - First order partial differential equations, Formation of partial differential equations from given solutions, four standard forms of non-linear first order equations. Application of first order partial differential equations: One dimension a Heat and Wave equation, Two-dimensional Heat equation.	20%	18
Unit 3: Fourier series -Half-ranged cosine and sine series.	20%	14
Unit 4: Probability - Definitions of probability, sampling theorems, conditional probability	20%	10
Unit 5: Statistics - mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.	20%	8

Instructional Method and Pedagogy: Chalk board, Tutorial

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Understand behavior of complex functions as compared to real functions	Cognitive	Understand
CO2: Introduce special differential equations and to learn series solution methods to solve them	Cognitive	Introduce
CO3: Study periodic functions and their representations as series	Cognitive	Study
CO4: Introduce students to partial differential equation	Cognitive	Introduce
CO5: Study some important partial differential equations and their solutions	Cognitive	Study

Learning Resources

1.	Reference Books: 1. Churchill, R.V., and Brown, J.W., Complex variables and applications, 7th edition, McGraw Hill, (2003) 2. Boyce, W.E., and DiPrima, R., Elementary Differential Equations, 8th Edition, John Wiley & Sons, (2005). 3. Churchill, R.V., and Brown, J.W., Fourier series and boundary value Problems, 7th Edition, McGraw- Hill, (2006). 4. Kreyszig, E., Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, (1999).
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2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Article Review	10 marks										
Total	40 Marks										

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	0	3	0
CO2	1	0	3	0
CO3	1	0	3	0
CO4	1	0	3	0
CO5	1	0	3	0
Avg.	1	0	3	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	0	0	0	1	0	0	1	0	2
CO2	1	1	0	0	1	0	0	0	0	1	0	1
CO3	2	1	0	0	0	0	0	0	0	1	0	1
CO4	2	2	2	1	2	0	1	1	1	1	0	2
CO5	3	2	2	2	2	0	0	1	1	1	0	2
Avg.	2	2	1	1	1	0	0	0	0	1	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE BTFS311	COURSE NAME Safety Management I	SEMESTER III
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Fundamentals of Fire & Environment, Health, Safety
Course Category	Professional Core
Course focus	Skill Development
Rationale	The primary objective of safety management is to ensure the safety and well-being of individuals. By implementing effective safety measures,



	organizations demonstrate their commitment to protecting human life and minimizing harm. Compliance with safety regulations and standards is not only a moral obligation but also a legal requirement for organizations. Governments and regulatory bodies impose safety regulations to protect workers, consumers, and the public. Safety management provides a framework for organizations to identify and address potential hazards, ensuring compliance with applicable laws and regulations. Accidents and incidents can have severe financial implications for organizations. They can result in property damage, production delays, litigation costs, fines, and reputational damage.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To Understand the basic concept of safety and its development process up to the modern concept 2: To Understand safety philosophy, safety psychology, principles of general management 3: To Understand the managerial functions of safety planning, organizing, directing and controlling for industrial safety activities 4: To Understand the safety management techniques of education and training, motivation and participation of employees in safety costs calculation of accidents. 5: To Understand the relevance to safety budget and management information system for safety

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction: The Concept of Safety -. Need, Nature & Importance -. Focus on “Human Resource”. Safety of “Man” at the center -The concept development as Accident prevention, Occupational health and Environmental protection-. The modern concept of SHE or HSE Problems of Industrial Safety & Accident -. Occupational Health and Environmental Pollution-Factors impeding safety -. Reasons of accident prevention Importance of Safety Technology and Engineering for minimizing the accidents. PHILOSOPHY OF SAFETY: -Meaning of Philosophy and Safety Philosophy. Its scope. -Explanation of basic Definitions and Safety Terminology, Incident, accident major accident hazard (MAH), oversight, error, mistake, near miss, injury, unsafe act, unsafe condition, hazard, risk etc.-Accident Causation Theories -H W Heinrich’s Ten Axioms of industrial safety.-. Heinrich’s Domino Theory and his “ratio”. -Accident Prevention. -Five Fundamentals of Accident Prevention – Organization, Fact Finding, Analyses of the facts, Selection of Remedy and Application of Remedy. -Five “E” s of Accident Prevention – Engineering control, Education and training, Enforcement, Enthusiasm and Example setting. SAFETY PSYCHOLOGY: - Meaning of psychology, safety psychology and its importance. - Psychological factors affecting work and	20%	10



accidents. - Attitudes, Aptitudes, Frustration, Conflict, Morale, Fatigue Boredom & Monotony. -. Role of these factors in accident causation and techniques to remove ill effects due to them. - Human Behavior: Individual differences. Behavior as function of self and situation, perception of danger and risk. Knowledge and responsibility vis-à-vis safety performance- Motivation for Safety: Need and Nature of Motivation. Theories of motivation and their application to safety. Role of Management, Supervisors and Safety Department in motivation. Behavior based safety (BBS) Management Program.		
Unit 2: SHE Management & planning for safety: - Planning: Definition, purpose, nature, scope and procedure. - Range of planning & variety of plans. - Strategic planning and tools of implementation. - MBO i.e., Management by objectives and its role in Safety, Health and Environment (SHE). - Safety Policy – Formulation and implementation. Statutory provisions. ORGANIZING FOR SAFETY. - Organizing: Definition, need, nature and principles. - Organizing for Safety or SHE Department.-. Types, structure, functions and responsibilities. - Line and Staff Functions for SHE. -Role of Supervisors, Workers and Trade Unions. DIRECTING FOR SAFETY: -Direction: Definition, process, principles and techniques, Leadership: Role, functions and attributes of a leader, Leadership styles in safety management. - Communication: Purpose, process, types and channels, Essential rules in communication, Two-way communication, Barriers in communication, Essentials of effective communication, Communication and group-dynamics. Team building.	20%	10
Unit 3:. Controlling for Safety: -Controlling: Definition, need, benefits types, areas, elements and control techniques -.MBE i.e., Management by Exception. - Monitoring by Safety Standards.-. Application and use of Indian Standards on Safety and Health:IS:14489 and IS:15001, OHSAS 18001. ILO and EPA Standards. SAFETY EDUCATION AND TRAINING: - Assessment of Training: Elements of training cycle, Assessment of training needs, Objectives of training program. - Techniques of training, Design and development of training programs, Training methods and strategies. - Types of safety training, Evaluation and review of training programs, Modern methods of training, Modern teaching aids, Integration of safety training with job training, - Competence Building Technique (CBT), Concept for training Safety as on- line function, Role of Multimedia and Communication, Applications of Computers, Relevance of WTO regarding SHE.	20%	9
Unit 4: Employee participation in safety: Employee Participation: Purpose Areas and Methods of participation, Workers' and Union's participation. Safety Promotion and Publicity: Safety suggestion schemes, Safety-competitions, Safety incentives schemes, Audio-visual publicity and other promotional methods, Safety Performance Awards and Recognition.-. Safety Committee: Structure, functions, meetings, minutes and implementation of its own remarks. Statutory provisions.-. Approaches to Compliance and Violations. ECONOMICS OF SAFETY: Cost of accidents: Direct and	20%	8



Indirect costs and their ratio, Usefulness to convince management.-. Financial costs: Financial costs to individual, his family, organization and society, Cost compilation procedure, Utility and limitations of cost data.-. Budgeting for safety, Purpose and procedure of safety budgeting, Consideration of Performance Rates.		
Unit 5: Management Information System: - Sources of information on Safety, Health and Environment Protection, Compilation and collation of information, its analysis and use, “Benchmarking” for safety performance - Modern methods of programming, Storing and retrieval of MIS for SHE. Computer Software Application and Limitations. Causes of MIS failure. Advantages and disadvantages of computerized information system. Status and future goals of computer utilization in SHE services in industries. Integration between departmental MIS.	20%	8

Instructional Method and Pedagogy: PPT, Video Presentation, Chalk board

Course Objectives:	Blooms’ Taxonomy Domain	Blooms’ Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand the basic concept of safety and its development process CO2: Remember safety philosophy, safety psychology, principles of general management CO3: Understand the managerial functions of safety education and training CO4: Evaluate the employee participation in safety CO5 : Apply the management information system in various aspects of management	Cognitive	Understand Remember Understand Evaluate Apply

Learning Resources	
1.	Reference Books: 1. Accident Prevention Manual for Industrial Operations, National Safety Council, 425, North Michigan Ave, Chicago, Illinois, USA. 2. Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva. 3. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York.
2.	Journals & Periodicals:
3.	Other Electronic Recourses :



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	2	2	1	1
CO3	2	1	0	0
CO4	2	0	1	1
CO5	1	1	1	1
Avg.	2	1	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2
CO2	3	1	0	0	1	2	1	1	0	0	0	2
CO3	3	1	0	1	3	2	2	2	2	1	1	2
CO4	1	3	2	3	2	2	1	1	2	1	2	2
CO5	2	1	1	2	2	3	3	2	2	2	1	2
Avg.	2	1	1	1	2	2	2	2	2	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE BTFS312	COURSE NAME Legislations related to Fire & Safety, Health Environment	SEMESTER III
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	1	4	3	0	1	4

Course Pre-requisites	Fundamentals of Fire & Environment, Health, Safety
Course Category	Professional Core
Course focus	Skill Development
Rationale	The primary objective of fire safety legislations is to protect human life and property from the devastating effects of fires. These laws require the implementation of preventive measures, such as fire detection systems, fire suppression equipment, and evacuation plans, to minimize the risk of fire incidents and provide a safe environment for people to live and work. Legislation related to environmental protection aims to prevent and mitigate environmental damage caused by human activities. These laws establish standards and regulations for industrial processes, waste management, emissions control, and pollution prevention to safeguard air, water, and soil quality. Health and safety legislations are designed to ensure that workplaces are safe and free from hazards that could cause harm to employees. These laws require employers to identify and assess workplace risks, implement measures to control hazards, provide appropriate training and personal protective equipment, and establish protocols for reporting and investigating accidents or incidents.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To Understand the significance of Indian factories act and rules 2: To Understand the significance of chemical & explosive acts 3: To Understand the provisions and rules related to pollution control



- 4: To **Understand** the provisions and rules related to construction, docks & mine workers
5: To **Remember** the roles and responsibilities of regulatory authorities

Course Content (Theory)	Weightage	Contact hours
Unit 1: The importance & relevance of Factories Act 1948, Gujarat Factories rules 1963. . Fire Prevention & Life Safety Measures Act 2013 and Rules 2016.	20%	10
Unit 2: The importance & relevance of Indian Explosive Act 1884 and Explosive rules, Gas Cylinder Rules 2004, Petroleum Act 1934 with Rules 2002, Calcium Carbide Rules 1987. Static & Mobile Pressure Vessel Rules. Fire Insurance Assessment.	20%	10
Unit 3: The importance & relevance of Environment (Protection) Act 1986 MSIH Rules. Water (Prevention and Control of Pollution) Act. Air (Prevention and control of pollution) Act. Chemical Accidents (Emergency, Planning, preparedness and response) Rules 1996	20%	10
Unit 4: The importance & relevance of Other Important Legislations: Boilers Act 1923, Electricity Act 2003 with rules, Public Liability Act 1991, Dock workers (Safety, Health & Welfare) Act. Safety & Health provisions of Building & other construction workers Act 1986 and central rules 1998 and Mines Act.	20%	10
Unit 5: Role & responsibilities of Regulatory authorities like DISH, PESO, MOEF&CC GPCB & CPCB.	20%	5

Instructional Method and Pedagogy: Power Point Presentation ,Case study

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand the significance of Indian factories act and rules CO2: Understand the significance of chemical & explosive acts CO3: Understand the provisions and rules related to pollution control CO4: Understand the provisions and rules related to construction, docks & mine workers CO5: Remember the roles and responsibilities of regulatory authorities	Cognitive	Understand Understand Understand Understand Remember

Learning Resources



1.	Reference Books:.
	1. Factories Act – 1948 & Gujarat Factories Rules – 1963 with latest amendment 2. Environment Protection Act 3. Petroleum Acts & Rules 4. Boiler Acts 5. Electricity Acts & Rules 6. Building & other Construction workers Act 1986
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Article Review	10 marks										
Total	40 Marks										

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	3	2	2
CO3	1	0	2	3
CO4	2	2	2	2
CO5	2	2	2	2
Avg.	2	2	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2
CO2	3	1	0	1	3	2	2	2	2	1	1	2
CO3	3	1	0	1	3	2	2	2	2	1	1	2



B.Tech Fire &EHS

Course Curriculum

Academic Year 2022-23

CO4	3	1	0	1	3	2	2	2	2	1	1	2
CO5	3	1	0	0	1	2	1	1	0	0	0	2
Avg.	3	1	0	1	3	2	2	2	2	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS313	COURSE NAME Town Planning and Building Design	SEMESTER III
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	Engineering Graphics
Course Category	Engineering Science
Course focus	Skill Development
Rationale	To create functional, sustainable, and aesthetically pleasing communities. It involves the careful consideration of various factors, including population growth, land use, transportation, infrastructure, environmental impact, and social needs. Town planning aims to optimize land use by allocating different areas for residential, commercial, industrial, and recreational purposes. This ensures that land is utilized effectively and minimizes sprawl, reducing the need for long commutes and preserving natural areas. Proper town planning considers the provision of essential infrastructure and services such as roads, utilities (water, electricity, gas), schools, hospitals, parks, and public spaces. By strategically locating these facilities, planners can improve accessibility, enhance quality of life, and promote community well-being. An effective town plan incorporates transportation systems that facilitate easy movement within and between communities.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To study Civil engineering drawings, symbols related to buildings 2: To impart knowledge on National Building Code for Civil engineering structures 3: To study building and town planning and their development controls 4: To gain knowledge on hazard, risk and vulnerability analysis 5: To design layouts of various types of public buildings

Course Content (Theory)	Weightage	Contact hours
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Unit 1: Types of Drawing: Appropriate scale & uses index map- key plan-village map-site plan-layout plan -Types of Projection adopted in Building Drawing. Symbols- Conventions and Abbreviations for - Electrical fittings- water supply-sanitary fittings- material for construction etc. Sizes of various standard papers-Introduction to buildings- Type of buildings-Building Services – Introduction of Building Services like water supply and drainage-electrification -ventilation and lightening and staircases - fire safety- thermal insulation- acoustics of buildings.	20%	8
Unit 2: Principles of Building planning: Principles of architecture composition Building by-laws as per National Building Code, Standards for residential buildings, building by-laws of local authority, standards for industrial, public commercial and institutional buildings Preparing working drawing of residential building software application in planning, detached, semidetached, row houses and apartments with scale proportion, open spaces standard as per F.S.I. permissible – Elements of perspective views – Types of views such as one point, two point perspective	20%	12
Unit 3: Town planning: Planning surveys-selection of site for urban development- consideration cleats- Topography- Drainage and water supply etc. Types of roads in urban areas communication system and it relationship to the cities. Multi story flats, -Group Housing- Group Ware Housing- Commercial complexes-and Detached and Semidetached houses in relation to fire risk-Types of housing units- Layout of Housing areas with consideration of site orientation, -views and architectural aesthetics	20%	12
Unit 4: Hazard, Risk and Vulnerability analysis in town planning, Risk informed town planning. Fundamental principles of Town Planning- Land use Planning and percentage of different Land uses as per category of town-Components of town such as Zones-Road Network- CBD- Neighborhood Planning-Development controls for new town planning schemes for growth negotiation Formation of Slums-Reasons of Slum formation-and remedial measures for avoiding slum foundation Introduction to smart city- its Characteristics as per present Scenario	20%	8
Unit 5: Case study on Town planning: Design of Public Buildings- Consideration in planning of schools- Colleges & Libraries- Consideration in planning of Hospitals- Hotels- Consideration in planning of Cinema Theatres- office buildings- Consideration in planning of markets-High rise Buildings etc.	20%	5

List Of Practical	Weightage	Contact hours
7. Four A1 Size Drawing sheet: Residential Planning: Single storied Building: Plans, elevation, section lay-out plan, key plan, site plan, area table, schedule of opening. Scale-1:100.	20%	6
8. Residential Planning: Two storied Building: Plans, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening. Scale-1:100.	20%	6
9. Public Building school plan: Ground Floor plan, typical floor plan, elevation,	20%	6



section, lay-out plan, key plan, site plan, area table, schedule of opening.		
10. Public Building public health center plan: Ground Floor plan, typical floor plan elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.	20%	6
11. Working Drawing: sheet should accommodate min. six types with sectional details. (Furniture plan, Drainage lay out, Toilet Detail, Woodwork detail, Kitchen detail Electrical plan etc). Perspective Drawing: Two-point perspective of sheet -1 planning.	20%	6

Instructional Method and Pedagogy: PPT, Chalk Board, Tutorials

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember terminologies & symbols used in buildings CO2: Understand bye-laws and provisions of National Building Code CO3: Create layouts of various occupancies in town planning CO4: Analyze hazard, risk and vulnerability in town planning CO5: Create layouts of public buildings	Cognitive	Remember Understand Create Analyze Create

Learning Resources

1.	Reference Books: 1. Town Planning by G. K. Hiraskar 2. National Building Code-2005, New Delhi 3. Building Planning, Designing and scheduling by Gurucharan Singh, Standard Book House, New Delhi 4. General Development Control Regulations published by AUDA and GICEA 5. Town Planning by S.C. Rangwala, Charotar publishing House, Anand
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks



Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	1	0	1
CO2	2	2	0	2
CO3	2	1	0	1
CO4	2	2	0	2
CO5	2	1	0	1
Avg.	2	1	0	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	0	2	2	0	0	0	0	2
CO2	2	0	0	0	1	2	1	3	0	0	2	2
CO3	0	3	2	0	0	0	2	0	2	0	0	2
CO4	0	3	2	2	0	0	0	0	2	0	1	1
CO5	0	3	2	0	0	0	2	0	2	0	0	2
Avg.	1	2	1	0	0	1	1	1	1	0	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE BTFS314	COURSE NAME Strength of Materials	SEMESTER III
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	Engineering Mechanics
Course Category	Engineering Science
Course focus	Skill Development
Rationale	The strength of materials is crucial for ensuring the structural integrity of various applications, such as buildings, bridges, aircraft, vehicles, and machinery. By analyzing and predicting the strength of materials, engineers can design structures that can safely carry anticipated loads and stresses without collapsing or deforming excessively. Understanding the strength of materials is essential for ensuring the safety and reliability of structures and components. By accurately assessing the strength properties of materials, engineers can determine their maximum load-carrying capacities and establish appropriate safety factors to prevent catastrophic failures. Different materials exhibit varying strengths, and selecting the appropriate material for a particular application requires a thorough understanding of their strength properties.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To study the fundamental principles & various theories of stresses and strains. 2: To determine the magnitude and characteristics of compound stresses and Strains of static elements 3: To analyze different types of stresses and strains developed in structural members to axial, bending, shear, and torsional effects 4 : To determine shear force and bending diagram of a different geometrical shape and able to understand its importance 5: To solve torsion problems in bars

Course Content (Theory)	Weightage	Contact hours
Unit 1: Simple Stresses and Strains: Introduction, Basics of stress and strain, Stress and strain diagram, Elasticity and plasticity, Types of stresses and strains, Hooke's law, Working stress, Lateral strain, Poisson's ratio and volumetric strain, Bars of varying section, Composite bars, Temperature stresses, Resilience, Gradual, sudden, impact and shock	20%	9



loadings, Simple applications.		
Unit 2: Compound Stresses and Strains: Introduction, Two dimensional stress-strain system, Stress at a point on a plane, Principal stresses and principal planes, Mohr circle of stress, Principal strains and principal axis of strain, Relationship between elastic constants.	20%	9
Unit 3: Shear Force and Bending moment: Introduction, Bending moment (BM) and shear force (SF) diagrams for cantilevers simply supported and fixed beams with or without overhangs, Maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, applications.	20%	9
Unit 4: Flexural Stresses & Shear Stresses: Introduction, Theory of simple bending, Assumptions, Neutral axis, Bending stresses, Section modulus of rectangular and circular sections (Solid and Hollow), I- section, T-section, Angle and Channel sections, Design of simple beam sections, Shear Stresses, Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, and angle sections. Deflection of Beam.	20%	9
Unit 5 Torsion and Bending of Shafts: Introduction, Theory of pure torsion, Assumptions, Torsion of the hollow and solid circular shafts, torsional rigidity, Power transmission by shaft, Shaft in series, Shaft in Parallel, Shaft bending, Combined torsion and bending of circular shafts.	20%	9

List Of Practical	Weightage	Contact hours
9. To study the Universal Testing Machine (UTM) and perform the tensile test	20%	5
10. To perform compression test on Compression Testing Machine (CTM).	15%	5
11. To study the Izod Impact Testing machine and perform Izod impact test.	15%	4
12. To study the Charpy Impact Testing machine and perform Charpy impact test.	15%	4
13. To study the Brinell Hardness testing machine and perform Brinell hardness test.	15%	4
14. To perform torsion test on mild steel rod.	10%	4
15. To perform the bending test on UTM.	10%	4

Instructional Method and Pedagogy: PPT, Chalkboard, Animated Videos, Tutorial

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will		



be able to:

CO1: **Analyze** the simple stresses in bars, composite bars, thermal stresses and strain energy
 CO2: **Analyze** the stresses in two dimensional bodies and evaluate the deformation in thin, thick cylinders and spherical shells
 CO3: **Evaluate** shear force, bending moment and stress distribution of various types of beams with different support
 CO4: **Apply** the deflection of the beams through various methods
 CO5: **Understand** the deflection of all types of shafts due to torsion and deformation of various types of springs

Cognitive

Analyze
 Analyze
 Evaluate
 Apply
 Understand

Learning Resources

1.	Reference Books: 1. Timoshenko, S. and Young, D. H., Elements of Strength of Materials, DVNC, New York, USA. 2. Hibbeler, R. C. Mechanics of Materials, East Rutherford, NJ: Pearson Prentice Hall, 2004 3. Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf, Mechanics of Materials, TMH 2002. 4. Egar P. Popov and Toader A . Balan, Engineering Mechanics of Solids, Pretice Hall of India Pvt Ltd, New Delhi, 2002. 5. Ramamrutham S, Strength of materials, Dhanpat Rai, New Delhi. 6. Bhavikatti S, Strength of Materials, Vikas Publication House, New Delhi,2007 7. R. K. Bansal, Strength of materials, Laxmi Publication
2.	Journals & Periodicals: 1. Mechanics Based Design of Structures and Machines 2. Engineering Structures Journal of Computational Design and Engineering
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks



Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	2	0	1
CO2	1	1	0	1
CO3	1	1	0	0
CO4	2	0	0	1
CO5	1	1	0	1
Avg.	1	1	0	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	0	2	2	0	1	3	3	0	1
CO2	3	2	3	0	2	0	1	3	0	0	3	2
CO3	3	2	3	1	1	2	3	2	1	2	0	2
CO4	3	2	3	1	1	0	3	0	1	3	3	1
CO5	3	2	3	1	0	0	3	0	0	2	2	1
Avg.	3	2	3	1	1	1	2	1	1	2	2	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE	COURSE NAME	SEMESTER
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
4	2	0	6	4	2	0	5

Course Pre-requisites	Engineering Mechanics
Course Category	Engineering Science
Course focus	Skill Development
Rationale	Machine design aims to create machines and mechanical systems that fulfill specific functions and requirements. By considering the intended purpose, engineers can design machines that operate efficiently and reliably. Industrial drafting, on the other hand, helps in visualizing and documenting the design, ensuring that all components fit together and function properly. Machine design focuses on optimizing the efficiency and performance of machines. By considering factors such as power transmission, motion control, material selection, and manufacturing processes, engineers can design machines that maximize output while minimizing energy consumption and operational costs. Industrial drafting helps in visualizing the design layout, identifying potential bottlenecks, and optimizing the arrangement of components to achieve better performance. Machine design and industrial drafting serve as a common language between engineers, manufacturers, and other stakeholders involved in the production process. Drafting standards, such as those specified by ISO (International Organization for Standardization), ensure consistency and clarity in conveying design information.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To Understand contemporary techniques in effectively designing the machine elements 2. To Understand the concepts involved in the analysis of mechanical elements by considering the various stresses encountered by the machine element machine element. 3: To Adapt the different techniques for making production drawings. 4: To learn a drafting package and to learn how to create mechanical drawings in the drafting package. 5 :To Design/Create the mechanical elements.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Fundamentals of Machine Design: Definition and understanding	20%	12



of various types of design, Morphology of design, Design procedure, Various parameters related to Design, Comparison of Conventional Design and Computer Aided Design, Selection of materials, Properties and I.S. coding of various materials, factors of safety, Types of stresses - tensile, compressive, shear, bending, bearing, crushing, Eccentric stress, principal stress, Residual stresses, Thermal Stress, Stress Concentration and methods of relieving stresses.		
Unit 2: Design of Joints: Design of Cotter and Knuckle Joints: Introduction, Types of cotter joints, Design of spigot and Socket cotter joint, Sleeve and Cotter joint, Gib and cotter joint, Knuckle Joint, Methods of failure of Knuckle joint, Design procedure for knuckle joint, Design of Turn Buckle. Design of Riveted Joints: Introduction, Methods of Riveting, Types of Rivet heads, Types of Riveted Joints, Lap joint, Butt joint, Important terms used in Riveted joints, Caulking and Fullering, Failure, Strength and Efficiency of Riveted joints, Design of Boiler joints. Welded Joints: Types of welded joints, stresses in welded joints, Design for various loading conditions in torsion, shear, or direct load, eccentrically loaded welded joints, welding symbols.	20%	12
Unit 3 - Design of Shaft: Introduction, Classification of Shafts, Size and Shape of Shaft, Design of solid and hollow shaft considering shaft subjected to twisting moment, bending moment, combined T.M and B.M. and subjected to axial forces, Shafts subjected to Fluctuating loads, Design of shaft for critical speed design of shaft for rigidity and stiffness, flexible shafts.	20%	12
Unit 4: Keys and Couplings: Introduction, Classification of Keys and Couplings, Design of different types of keys, design of Muff, Clamp coupling, Rigid coupling, Flange Coupling, Flexible couplings, Oldham Coupling. Design of Levers: General Procedure for design of levers, design of lever for various applications like safety valve design of bell crank lever, design of rocker arm for exhaust valves.	20%	12
Unit 5: Design of Pressure Vessels: Classification of pressure vessels, Design of thin cylindrical vessels and thin walled spherical vessels based on internal pressure, Joint efficiency, Design of thick cylinders subjected to internal pressure, Design of cylinders subjected to external pressure, Design of compound cylinders subjected to internal and external pressure, Design equations based on failure theories, Pre stressing of thick cylinders, Formed heads or end covers, Introduction of different standards used for pressure vessel design.	20%	12

List Of Practical	Weightage	Contact hours
1. Drawings of assembled view for the part drawings of the following using propionate dimensions.	20%	5
2. Engine parts – cylinder, liners, piston, connecting rod, crank shaft,	20%	5



stuffing boxes, cross heads, Eccentrics.		
3. Machine parts - Screws jacks, Machine Vices, Plummer block, Tailstock.	20%	5
4. Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock.	20%	5
5. Elements of production drawing, Fits and tolerance, allocation of fits for various mating parts, tolerance data sheet, and tolerance table preparation Geometric tolerance, Bill of Material.	10%	5
6. Surface roughness: Roughness and Machining symbols, indication on drawings.	10%	5

Instructional Method and Pedagogy: PPT, Chalk board, Tutorial

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand the contemporary techniques in effectively designing the machine elements CO2: Understand the concepts involved in the analysis of mechanical elements by considering the various stresses encountered by the machine element machine element. CO3: Apply the different techniques for making production drawings. CO4: Understand drafting package and to learn how to create mechanical drawings in the drafting package. CO5: Design/Create mechanical elements.	Cognitive	Understand Understand Apply Understand Create

Learning Resources

1.	Reference Books: 1. Machine Design by P.C. Sharma and Agarwal, Katsons Publications 2. S. G. Kulkarni, "Machine Design - Solved Problems", Tata McGraw Hill Publishing Company Ltd., New Delhi 3. William Orthein, "Machine Component Design (Vol. I & II)", M/s. Jaico Publishing 4. N.D. Bhatt, "Machine Drawing" –Charator Publication 5. Machine Design by R.S. Khurmi, S. Chand Publications
2.	Journals & Periodicals: 1. Knowledge-Based Systems 2. Journal of Computational Design and Engineering 3. Engineering optimization 4. Expert Systems with Application



	5. Engineering with Computers
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	0
CO2	2	3	1	0
CO3	1	2	1	0
CO4	2	1	1	0
CO5	1	1	3	0
Avg.	2	2	2	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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B.Tech Fire &EHS

Course Curriculum

Academic Year 2022-23

CO1	3	1	0	1	0	0	0	0	0	1	1	2
CO2	3	1	0	2	0	0	0	0	0	1	1	1
CO3	3	2	1	1	0	0	0	0	0	2	1	3
CO4	3	0	0	1	0	0	0	0	0	0	1	2
CO5	3	1	3	1	0	0	0	0	0	2	1	2
Avg.	3	1	1	1	0	0	0	0	0	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE AECC301	COURSE NAME Entrepreneurship Development	SEMESTER III
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2

Course Pre-requisites	
Course Category	Ability Enhancement Compulsory Course
Course focus	Entrepreneurship
Rationale	Entrepreneurship development is crucial for economic growth and societal progress. It plays a vital role in job creation, innovation, and overall economic development. Entrepreneurs are often the driving force behind job creation. They establish new businesses, expand existing ones, and employ people. By creating job opportunities, entrepreneurs contribute to reducing unemployment rates and enhancing economic stability. Entrepreneurship fosters innovation by encouraging individuals to develop new ideas, products, and services. Entrepreneurs are typically driven by a desire to solve problems and meet market demands. Entrepreneurship plays a significant role in driving economic growth. It introduces new businesses, products, and services into the market, which can generate revenue, increase productivity, and attract investments. Entrepreneurship provides opportunities for wealth creation, not only for entrepreneurs themselves but also for society as a whole. Successful entrepreneurs generate profits, accumulate wealth, and reinvest it back



	into the economy.
Course Revision/ Approval Date:	5th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: Students will develop skills for evaluating, articulating, refining, and pitching a new product or service offering. 2: To Identify the elements of success of entrepreneurial ventures. 3: To Analyze Feasibility of the project (Financial and Non-Financial) and interpret business plan. 4 : To Demonstrate and present successful work, collaboration and division of tasks in a multidisciplinary and multicultural team. 5: To Demonstrate understanding and application of the tools necessary to create sustainable and viable Businesses.

List Of Practical	Weightage	Contact hours
Unit-1: Introduction: Meaning, Needs and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.	20%	6
Unit-2 : Establishing an enterprise: Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility.	20%	6
Unit 3: Financing the Enterprise: Importance of finance / loans and repayments, Characteristics of Business finance, Fixed capital management: Sources of fixed capital, working capital its sources and how to move for loans, Inventory direct and indirect raw materials and its management.	20%	6
Unit 4: Marketing Management: Meaning and Importance, Marketing-mix product management – Product line, Product mix, stages of product like cycle marketing Research and Importance of survey, Physical Distribution and Stock Management.	20%	6
Unit 5 : Entrepreneurship and International Business: Meaning of International business, Selection of a product, Selection of a market for international business, Export financing, Institutional support for exports.	20%	6

Instructional Method and Pedagogy: PPT, Group Discussion, Roleplay

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Develop/ Create skills for evaluating, articulating,		



refining, and pitching a new product or service offering. CO2: Analyze the elements of success of entrepreneurial ventures. CO3: Analyze Feasibility of the project (Financial and Non-Financial) and interpret business plan. CO4: Develop/ Create present successful work, collaboration and division of tasks in a multidisciplinary and multicultural team. CO5: Understand the application of the tools necessary to create sustainable and viable Businesses.	Cognitive	Create Analyze Analyze Create Understand
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Learning Resources

1.	Reference Books: 1. Kaplan JM Patterns of Entrepreneurship. 2. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management, Sultan Chand & Sons.
2.	Journals & Periodicals: 1. The Journal of Entrepreneurship 2. Journal of Small Business and Entrepreneurship Development
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks



Practical Marks		
	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs & COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	0
CO2	1	1	1	0
CO3	1	1	1	0
CO4	1	1	1	0
CO5	1	1	1	0
Avg.	1	1	1	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	0	0	0	0	0	0	0
CO2	3	3	3	3	2	0	0	0	0	0	0	0
CO3	3	2	3	3	2	0	0	0	0	0	0	0
CO4	3	1	3	3	3	0	0	0	0	0	0	0
CO5	3	2	2	3	2	0	0	0	0	0	0	0
Avg.	3	2	3	3	2	0	0	0	0	0	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

**Teaching Scheme****Semester – IV**

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTFS411	Building Fire Prevention & Protection measures	3	0	0	3	3	0	0	3	20	40	40	100	-	100
2.	BTFS412	Hazard Identification, Risk assessment & Control techniques	3	0	1	4	3	0	1	4	20	40	40	100	-	100
3.	BTFS413	Safety in Construction Industry	3	0	0	3	3	0	0	3	20	40	40	100	-	100
4.	BTFS414	Basics of Occupational Health	3	0	0	3	3	0	0	3	20	40	40	100		100
5.	BTFS415	Fire drills & Practical	0	4	0	4	0	2	0	2	-	-	-	-	50	50
6.	BTFS416	Fluid mechanics & Pumping machinery	3	2	0	6	3	1	0	4	20	40	40	100	50	150
7.	AECC401	Environmental Studies	2	0	0	2	2	0	0	2	20	40	40	100	-	100
8.	BTFS409	Internship	0	0	0	2	0	0	0	2	-	-	-	-	100	100
		Total				27				23						800

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester





COURSE CODE BTFS411	COURSE NAME BUILDING FIRE PREVENTION & PROTECTION MEASURES	SEMESTER IV
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Town planning & building design.
Course Category	Professional Core
Course focus	Skill development
Rationale	The rationale behind building fire prevention and protection measures is to ensure the safety of occupants, protect property, and minimize the risk of fire-related incidents. Fires can have devastating consequences, causing injuries, loss of life, and significant damage to buildings, assets and the environment. By implementing fire prevention and protection measures, the goal is to reduce the likelihood of fires occurring, limit their spread if they do happen, and facilitate safe evacuation and fire fighting.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: To provide fundamental understanding of Building design with respect to fire and life safety 2: To understand building occupancies and their characteristics and how these influence fire safety design aspects 3: To recognize the importance of fire prevention in buildings and how this is achieved in practice 4: To become familiar with life safety and fire protection arrangements in buildings and their design aspects 5: To introduce students to basic code requirements/ rules for buildings, which need to be applied from fire safety point of view

Course Content (Theory)	Weightage	Contact hours
Unit 1: General Principles of Fire Prevention and Protection: Occupancy classification of buildings and their characteristics. Zoning of city areas. Site requirements, type of construction required with respect to fire resistance, fire separation, compartmentation, isolation.	20%	9 hours
Unit 2: Internal Planning and layout of Building Services and systems, hazardous areas and pipelines, vessels and equipment, and fire prevention measures provided. Fire prevention measures for different	20%	9 hours



building systems i.e., electrical, HVAC, service ducts, fuel gas supply. Structural fire safety, compartmentation and segregation of hazardous areas.		
Unit 3: Different factors affecting safe egress from buildings in an emergency and how building codes address these factors. Code requirements for safe egress design, including associated systems such as emergency lighting, signage, smoke control, etc. Design of egress components i.e., doors, stairs, ramps and code requirements	20%	9 hours
Unit 4: Common fire protection systems for buildings: Portable extinguishers, Rising mains-wet & dry, sprinkler systems, drenchers, etc. – their applicability and requirement as per building codes. Special systems such as water spray systems, clean agent, foam systems, water mist, etc.	20%	9 hours
Unit 5: Fire Safety management and emergency response organization for buildings. Importance of Emergency plans, roles and responsibilities of various teams, drills and evaluation, etc.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Case Studies, Site Visits, Video Presentation, Chalk board

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Domain	Sub
After successful completion of the above course, students will be able to: CO1: Understand importance of different design features of building CO2: Remember classification of buildings and code requirements such as construction elements, building services and features based on occupancy CO3: Apply concepts related to fire prevention in buildings, and associated features/ systems CO4: Understand concepts related to life safety and fire protection as applied in buildings and how they are applied in practice CO5: Evaluate code requirements/rules applied for fire & life safety design in building	Cognitive	Understand Remember Apply Understand Evaluate	

Learning Resources

1.	Reference Books: 1. Fire Service Manual Volume 3 Fire Safety, Fire Protection of Buildings, HMSO Publications 2. Dr. Than Singh Sharma, Fundamentals in building design. 3. National Building code of India 2016, Part-4, BIS 4. NFPA Fire protection Handbook, Section 1, 20th Edition.
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	5. Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers.
	6. Lon H. Ferguson, Fundamentals of Fire Protection for the Safety professional, The scarecrow Press, Inc.
	7. Hurley, Morgan, Section 1, SFPE Handbook, SFPE/NFPA, USA
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2
CO2	2	2	1	2
CO3	2	3	1	3
CO4	2	3	2	2
CO5	1	3	0	1
Avg.	2	3	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3	3
CO2	2	0	1	1	1	2	2	1	1	0	0	2	2
CO3	3	2	0	1	3	2	2	2	1	1	1	2	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3	3



B.Tech Fire &EHS

Course Curriculum

Academic Year 2022-23

CO5	2	2	0	3	2	3	2	3	1	1	1	3	2
Avg.	3	1	0	1	2	2	2	2	1	1	2	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS412	COURSE NAME Hazard identification, risk assessment and control techniques	SEMESTER IV
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	1	4	3	0	1	4

Course Pre-requisites	Safety management I
Course Category	Professional core
Course focus	Skill development
Rationale	The rationale behind hazard identification, risk assessment, and control techniques is to proactively manage and mitigate risks in order to prevent accidents, injuries, and adverse events. These processes are fundamental to maintaining a safe and healthy environment in various contexts, such as workplaces, public spaces, and even personal settings. By implementing hazard identification, risk assessment, and control techniques, organizations aim to prevent accidents, protect individuals, comply with legal requirements, reduce costs, improve decision-making, drive continuous improvement, and build a positive reputation. These practices contribute to a safer and healthier environment for all involved parties.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to:



- 1: To familiarize the student with basic terminology of hazard identification and risk assessment
- 2: To provide knowledge in both qualitative and quantitative risk assessment
- 3: To provide intense knowledge of risk control and management

Course Content (Theory)	Weightage	Contact hours
Unit 1: Hazards and Risks: Definitions& Terminology for hazard and risk assessment - Difference between Hazard and Risk and their co-relation's - Prioritization of hazards and risks - Hazard and Risk Progression Chart - Hazard Identification, Hazard analysis, Risk analysis: Risk assessment, Risk management.	10%	8 hours
Unit 2: Hazard and Risk Analysis: Quantitative and Qualitative Risk analysis – difference between qualitative semi-quantitative and quantitative methods, Hazard–Mishap Probability, Preliminary Hazard Analysis methods: HIRA (5 steps risk assessment), what if analysis, bow-tie analysis, checklist, questionnaire. Working examples of various techniques.	20%	12 hours
Unit 3: Failure Mode and Effect Analysis (FMEA) – What Is FMEA, Reasons for Using FMEA, FMEA Worksheet Format, FMECA, Benefits of FMEA and FMECA, Advantages & disadvantages. Preliminary Hazard Analysis (PHA) – Introduction, background, theory, methodology, worksheet, hazard checklist, examples, Advantages & disadvantages. Hazard Analysis (HAZAN) – Objectives, stages of HAZAN, choosing targets, estimation of probability of accidents in various processes/organisations, Methodology, examples, Advantages & disadvantages. Hazard and Operability study (HAZOP) – Introduction, background, theory, methodology, design requirements, guide words, worksheet, examples, Advantages & disadvantages.	30%	16 hours
Unit 4: Analysis Process for an Explosion, Analysis Process for a Fire, Analysis Process for a Toxic Release. Fire & Explosion Effects' evaluation, Toxic material storage Hazard Assessment, Introduction to Consequence Analysis and Calculations. Assessment of fire, explosion and toxicity by Dow & Mond index, Assessment of Reliability of vessels and safety fittings.	20%	12 hours
Unit 5: Variety of risks and assessment methods including FTA, ETA etc. Use of Computer Models. Data of Failure rates and its utility-Gas dispersion, Fire and Explosion Events, Assessment of probability (frequency) and consequence (effect). Types of damage and damage distances. Risk counter-X and F-N curves,	20%	12 hours

**Instructional Method and Pedagogy:**

PPT, Tutorial, Video Presentation

Course Outcomes:

	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember basic terminologies of hazard and risk in workplace CO2: Understand qualitative and quantitative method of risk assessments CO3: Apply qualitative methods of risk assessment in workplace CO4: Evaluate consequence of fire and explosion	Cognitive	Remember Understand Apply Evaluate

Learning Resources

1.	Reference Books: 1. Loss Prevention in the Process Industries – Frank P. Lees 2. Nigel Hyatt (2003) Guidelines for Process Hazards Analysis, Hazards Identification & Risk Analysis, Dyadem Press. 3. Trevor Kletz (2001) HAZOP & HAZAN, Ichem publications. 4. Clifton A. Ericson (2005) Hazard Analysis Techniques for System Safety, John Wiley & Sons. Methodologies for Risk & Safety Assessment in Chemical Process Industries 5. Technical Guidance on Hazard Analysis by National Safety Council 6. IS 3786 Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Accidents 7. IS 14489 Code of Practice for Occupational Safety & Health Audit
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks



Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Project/Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project/Industrial.	30 marks
	Industry/Universitymentor's feedback on the Project/Industrial.	30 marks
	Attendance	10 marks
	Total	100 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	2	3
Avg	3	3	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	2	1	1	2	2	3	3	2	2	2	1	2	2
CO4	1	3	2	3	2	2	1	1	2	1	2	2	1
Avg	2	2	1	2	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS413	COURSE NAME Safety in Construction Industry	SEMESTER IV
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Town planning & building design
Course Category	Professional core
Course focus	Employability
Rationale	Safety in the construction industry is of paramount importance due to several key reasons are Protecting Workers, Legal and Regulatory Requirements, Productivity and Efficiency, Reputation and Client Satisfaction, Cost Savings, Moral and Ethical Responsibility Overall, the rationale for safety in the construction industry is multifaceted, encompassing worker protection, legal compliance, productivity, reputation, cost savings, and moral responsibility. By implementing robust safety measures, construction companies can create a safer working environment, reduce accidents and injuries, and ultimately achieve successful project outcomes.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: To familiar with construction materials and activities involved 2: To understand the hazards and its associated risk involved in various construction activities 3: To learn the causes of construction site accidents 4: To understand different work permits and safety measures during demolition 5: To learn about occupational health and construction safety standards

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to Construction Engineering: Classical and modern building materials - Underground works: Excavation, drilling & blasting, trenching, strutting, piling & safety in using and operation machinery and equipment relating to above components - Above ground works: Scaffolding, Centering, Framework, Ladders, Concreting wall and floor openings, staircases and railings. Structural steel work including welding, cutting erection - Types of structures – Smart cities	20%	10 hours
Unit 2: Hazards in Construction Site: Initial site assessment - General site issues – Protection against falls, fragile roofs, protection against falling objects, drowning, excavation, electricity, fire & other emergencies, noise, health hazards, movement of people & vehicles, traffic routes, manual & mechanical material handling, chemical & biological hazards, work equipments.	20%	10 hours
Unit 3: Construction Accidents: Global construction industries – changes in the construction industries – low rise to high rise buildings - causes of	20%	9 hours



accidents – human, hectic schedule, organizational factors, insufficient data, site condition & ergonomics, weather – accident investigation – approaches to accidents - case site accidents/case studies		
Unit 4: Safety in Demolition & Work Permit: Safety in Demolition Operations: Planning & permit, Precautions prior to demolition. Protection of public - Precautions during demolition - Sequence of demolition operation from safety point – Hazards & its consequences, control measures. Work Permit: Permit to work – hot work, excavation, height work, confined space, lifting operations, lifting operations, electrical works, work at roofs – issuing authority.	20%	9 hours
Unit 5: Occupational Health & Safety Standards: Occupational health and safety of workers at construction sites - Occupational hazards & diseases. Personal protective equipment. Health & welfare measures. First aid facilities The Building & other Construction Workers (Regulation of employment and conditions of service) Act 1996 and central rules 1998.	20%	7 hours

Instructional Method and Pedagogy:

PPT, Animated Videos, Case Studies, Peer learning, Site visits, Video Presentation

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember construction materials and types of structures CO2: Understand the hazards & its risk in construction activities CO3: Analyze causes of construction accidents and its investigation CO4: Understand various work permits and steps involved in demolition CO5: Understand the occupational health & safety of the workers	Cognitive	Remember Understand Analyse Understand Understand

Learning Resources

1.	Reference Books: 1. Introduction to Health & Safety in Construction - Phil Hughes, Elsevier Publications, Second edition 2. Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979. 3. OSHA Construction Safety Handbook, 6th Edition, J. J. Keller & Associates 4. Fire Service Manual Volume 3, Basic Principles of Building Construction, HMSO Publications 5. Fire Service Manual Volume 2, Safe Work at Height, HMSO Publications
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2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2
CO2	3	2	1	1
CO3	3	2	1	1
CO4	3	2	1	1
CO5	3	2	3	1
Avg.	3	2	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	1	2	2	2	1	2	2	1	2	1	1	2	1
CO4	3	1	0	1	3	2	2	2	2	1	1	2	3
CO5	3	1	0	1	3	2	2	2	2	1	1	2	3
Avg.	3	1	0	1	2	2	2	2	2	1	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS414	COURSE NAME Basics of Occupational Health	SEMESTER IV
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Fundamentals of Fire & Environment, Health, Safety
Course Category	Professional Core
Course focus	Skill development
Rationale	The basics of occupational health are grounded in the rationale of promoting and preserving the health and well-being of workers in the workplace. Here are the key rationales behind the basics of occupational health such as Worker Health and Well-being , Prevention of Occupational Diseases and Injuries , Legal and Regulatory Compliance , Productivity and Performance , Cost Savings, Corporate Social Responsibility (CSR) . In summary, the basics of occupational health are driven by the rationale of protecting and promoting worker health, preventing occupational diseases and injuries, complying with legal requirements, enhancing productivity, achieving cost savings, and fulfilling corporate social responsibility. By implementing effective occupational health programs, organizations can create healthier work environments, benefit their employees, and contribute to sustainable and responsible business practices.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1. To demonstrate the anatomy and physiology of human organs, functions and effects of various hazards on the organs. 2. To explain the principles and nature of occupational health. 3. To represent importance of Occupational Health and its linkage with other fields. 4. To explain the management of occupational health considering practical and legal aspects

Course Content (Theory)	Weightage	Contact hours
Unit 1: Human Anatomy – 1: Definition anatomy and physiology, structural organization and body systems. Structure of cell, functions of its component, Structure & function of skeleton, joints. Blood - composition and functions of blood, significant disorders related to blood in humans. CNS- structure and function of nervous system, spinal cord (gross structure, reflex activity), brain and functions of its parts. Cardiovascular system - Heart: Functional Anatomy, The heart as a pump, Heart rate and Blood Pressure. Respiratory System - mechanisms of respiration, regulation of respiration, Lung Volumes and transport of respiratory gases	20%	9 hours



and contaminants. Respiration insufficiency - symptoms, diagnosis and oxygen therapy.		
Unit 2: Human Anatomy – 2: Digestive system - functions of different parts including liver, pancreas and G.I.T., digestion and absorption of nutrients/contaminants and disorders of GIT. Physiology of special senses (ear, eye, smell & taste), structure and function of skin, Eye, Ear and Lungs Reproductive system: Anatomy and physiology of male and female reproductive system, Excretory System, Structure and functions of kidney, physiology of urine formation	20%	9 hours
Unit 3: Occupational Health – 1: Introduction to Occupational Health, Aim and Definition as per world health organization, importance of occupational health and its relevance with other fields. History of OH in India & other countries, importance of occupational history of an employee. List of occupational deceases. The meaning of well-being (with reference to the definition used by the Economic and Social Research Council (ESRC)), The categories of occupational health hazard: chemical, physical, biological, psycho-social, ergonomic.	20%	10 hours
Unit 4: Occupational Health – 2: The prevalence of work-related sickness and ill-health with reference to reportable and self-reported sources of information, link between occupational health and general/public health. Concept and Effects of – industrial gases and dusts, noise & vibration, poor illumination, occupational/industrial carcinogens, toxic and poisoning substances.	20%	8 hours
Unit 5: Occupational health management: The role, function and benefits of occupational health services. Health assessment, eg, fitness for work, pre-placement/employment assessment, return to work, job-related medical screening. Advice to management, eg, input to risk assessments, no-smoking policy, absence management etc. Medical and health surveillance/periodical assessment.	20%	9 hours

Instructional Method and Pedagogy: PPT, Animated Videos, Case Studies

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember anatomy and physiology of human organs, functions and effects of various hazards on organs. CO2: Understand nature of occupational health. CO3: Understand importance of occupational health and its	Cognitive	Remember Understand Understand



linkage with other fields.

CO4: **Analyze** the management of occupational health considering practical and legal aspects.

Analyse

Learning Resources

1.	Reference Books: - David Grantham (2000) Occupational Health & Hygiene: Guidebook for the WHSO. - Anand Mahindra Kumar, Meena Verma (2010) Human Anatomy for Nursing and Allied Sciences, Jaypee Brothers Medical Publishers Pvt. Limited. - Chaurasia B. D. (2020) BD Chaurasia's human anatomy Vol. 1 & 2, CBS. - Barry S. Levy, David H. Wegman (1999) Occupational Health: Recognizing and Preventing Work-related Disease and Injury, Lippincott Williams and Wilkins; 4th edition. - Peter Baxter (2011) Hunter's Diseases of Occupations, Hodder Arnold; Tenth edition. - Margaret Matt, Joe Ziemian (1982) Human Anatomy Coloring Book: An Entertaining and Instructive Guide to the Human Body - Bones, Muscles, Blood, Nerves, and How They Work, Dover Publications. - Julia Smedley (2013) Oxford Handbook of Occupational Health (Oxford Medical Handbooks), OUP UK; Second edition.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
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CO1	0	0	3	0
CO2	0	0	3	0
CO3	1	1	3	2
CO4	1	1	3	1
Avg	1	1	3	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	1	2	2	2	1	2	2	1	2	1	1	2	1
Avg	3	1	1	1	2	2	2	2	2	1	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS416	COURSE NAME Fluid Mechanics & Pumping Machinery	SEMESTER IV
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	Engineering Fundamentals
Course Category	Engineering Science
Course focus	Skill development
Rationale	The rationale of studying fluid mechanics and pumping machinery lies in their crucial roles in various engineering disciplines and industries. Here are the key rationales behind the study of fluid mechanics and pumping machinery namely Understanding Fluid Behavior , Designing Efficient Fluid Systems, Pumping and Fluid Transport, Energy Efficiency and Conservation, Risk Assessment and Safety, Innovation and Advancements. In summary, the study of fluid mechanics and pumping machinery is driven by the rationale of understanding fluid behavior, designing efficient fluid systems, ensuring energy efficiency



	and conservation, assessing risks and safety, and fostering innovation. The knowledge and principles derived from fluid mechanics are vital for engineers across various industries, enabling them to design, operate, and optimize fluid systems and pumping machinery for enhanced performance, reliability, and sustainability.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions 2. To impart knowledge on pressure, flow path and streamline 3. To expose the students about discharge measurement, use of venturi-meter, orifice meter 4. To impart knowledge on performance characteristics of various pumps

Course Content (Theory)	Weightage	Contact hours
Unit 1: Theory: Dimensional Analysis: Dimensions and units; Dimensional homogeneity; Buckingham's pie theorem, Laws of Similarity. Flow in Pipes Friction losses in pipes; losses due to sudden enlargement and contraction. Hydraulic and energy gradient lines, siphon, pipes in series and parallel, branching of pipes. Water hammer problems.	20%	7 hours
Unit 2: Theory: Hydraulics: The flow of water through open channels, pipe hose and nozzles. Measures of flow, pressure and pressure drop. Kinematics of fluids flow: Type of flow, path lines and streamlines, equation of continuity, one dimensional method of flow analysis	20%	8 hours
Unit 3: Theory: Dynamics of fluid flow Energies-potential, pressure and kinetic, Momentum and energy equations for steady flow, Bernoulli's theorem and its applications. Fluid Measurement: Pressure measurements, use of piezometers and static tubes, velocity measurements, use of pitot-tubes, current meters. Discharge measurement, use of venturi meter, Orifice meter etc.	20%	10 hours
Unit 4: Theory: Principles of Hydraulic Machinery, Dynamic Section of Fluid, Dynamic force and torque executed by fluid jet on plain, curved stationary and moving vanes; Velocity Diagrams, work done by impact, pressure due to deviated flow. Pumps (Positive Displacement Pumps) Reciprocating pumps; Basic theory, types, construction, installation characteristics and operation and accessories.	20%	10 hours
Unit 5: Theory: Centrifugal pumps and its characteristics. Other water lifting devices, Ejector pumps, Air-lift pump installation operation. Parallel-Series Centrifugal pumps. Pump Section, Maintenance and application. Fire water pump house in industry, Pumps running sequence, Pressure criteria.	20%	10 hours



List Of Practical	Weightage	Contact hours
1. To determine the minor head loss coefficient for different pipe fittings.	25%	9 hours
2. To study the variation of friction factor f . For turbulent flow in rough and smooth commercial pipes.		
3. To obtain the Reynolds number in different flow conditions		
4. To determine the minor head loss coefficient for different pipe fittings	25%	8 hours
5. To study the variation of friction factor f . For turbulent flow in rough and smooth commercial pipes		
6. To calibrate Venturi meter and to study the variation of coefficient of discharge with the Reynolds number	25%	6 hours
7. To calibrate a rotameter and to study the variation of coefficient of discharge with the Reynolds number		
8. To determine the coefficient of discharge C_d , velocity C_v , and contraction C_c of various types of orifices		
9. Performance on hydraulic pumps: a) Single stage and multistage centrifugal pumps	25%	7 hours
10. Performance on hydraulic pumps: a) Reciprocating pump		

Instructional Method and Pedagogy: PPT, Chalk board, Video Presentation, Tutorial

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand the properties of fluids and flow in pipes CO2: Evaluate fluid pressure and velocity CO3: Understand coefficient of discharge by Bernoulli's theorem CO4: Apply working principles of various turbines CO5: Evaluate behaviour of centrifugal, reciprocating and rotary pumps	Cognitive	Understand Evaluate Understand Apply Evaluate

Learning Resources	
1.	Reference Books: 1. Fluid Mechanics” by Streeter V L and Wylie E B, 2. “Fluid Mechanics and Hydraulic Machines” by Rajput R K, 3. “Engineering Fluid Mechanics” by Kumar K L. 4. Fluid Mechanics, Y. Cengel and J. Cimbala, McGraw Hill Education (India) Pvt. Ltd, New Delhi, 2010.
2.	Journals & Periodicals:
3.	Other Electronic Resources:



Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs& COs

	PSO1	PSO2
CO1	1	0
CO2	1	1
CO3	1	2
CO4	2	0
CO5	2	0
Avg.	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2	3
CO2	1	3	2	3	2	2	1	1	2	1	2	2	1
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	2	1	1	2	2	3	3	2	2	2	1	2	2
CO5	1	3	2	3	2	2	1	1	2	1	2	2	1
Avg.	2	2	1	2	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE AECC401	COURSE NAME Environmental Sciences	SEMESTER IV
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2

Course Pre-requisites	-
Course Category	Ability Enhancement Course
Course focus	Employability/ Entrepreneurship/ Skill development
Rationale	The rationale of environmental studies stems from the recognition of the interconnectedness between human societies and the natural environment. The key rationales behind the study of environmental studies are Understanding Environmental Issues, Promoting Environmental Sustainability, Interdisciplinary Approach, Conservation of Biodiversity and Ecosystems, Environmental Policy and Governance, Environmental Justice and Equity. In summary, the rationale of environmental studies lies in understanding environmental issues, promoting sustainability, adopting an interdisciplinary approach, conserving biodiversity and ecosystems, addressing environmental policy and governance, and striving for environmental justice. Environmental studies provide the knowledge and tools necessary to address pressing environmental challenges and work towards a more sustainable and equitable future for both humans and the natural world.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1. To acquire an awareness of and sensitivity to the total environment and its allied problems 2. To make educated judgments about environmental issues 3. To develop skills and a commitment to act independently and collectively to environment sustainability 4. To debate environmental science with use of appropriate scientific information 5. To engage students of all disciplines to think critically, ethically, and creatively when evaluating environmental

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction of Ecology Ecology-Objectives and Classification Concepts of an ecosystem-structure & function of ecosystem components of ecosystem, Hydrological cycle, carbon cycle and carbon footprint computation oxygen cycle, Nitrogen cycle, Sulphur cycle	20%	6 hours



Unit 2: Ecosystems: Ecological pyramids of various ecosystems Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic ecosystem, Estuarine Ecosystem.	20%	6 hours
Unit 3: Air pollution and its control Introduction, Classification of air pollutants, air pollutants and their effects, acid rain, photochemical smog, particulates. Characteristics and biochemical effects of some important air pollutants, Effect of air pollutants on man and environment, Air quality standard, air monitoring and control of air pollution.	20%	6 hours
Unit 4: Water pollution and its control Introduction, Classification of water pollutants, physical, chemical and biological characteristics of waste water, wastewater treatment: Primary treatment- Sedimentation, coagulation, equalization, neutralization, secondary treatment-aerobic treatment-aerated lagoons, trickling filter, activated sludge process, oxidation ditch process, oxidation pond, anaerobic treatment-anaerobic sludge digestion, sludge treatment and disposal and tertiary treatment-evaporation, ion exchange, adsorption, chemical precipitation, Electrodialysis, reverse osmosis.	20%	6 hours
Unit 5: Solid and hazardous waste: pollution, treatment and disposal Introduction, Classification and origin, characteristics of solid wastes, objectives and considerations in solid waste management, methods of solid waste treatment and disposal - composting, land filling, thermal processes-incineration, pyrolysis, recycling and reuse of solid waste-co-disposal, bioconversion.	20%	6 hours

Instructional Method and Pedagogy: PPT, Animated Video, Case Studies

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember terminologies of environmental studies CO2: Understand concept of ecosystem & its interaction in environment CO3: Understand use of renewable and non-renewable energy in environment CO4: Understand various pollutions & its impact in environment CO5: Understand environmental laws & regulations	Cognitive	Remember Understand Understand Understand Understand

Learning Resources

1.	Reference Books:
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	1. Fundamental concepts in Environmental studies by DD Mishra, S. Chand Publishing, India 2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by PS Verma and VK Agarwal, S. Chand Publication, India 3. Fundamentals of Ecology by PD Sharma, Rastogi Publications 4. Ecology and Environment by PD Sharma, Rastogi Publications 5. Environmental Chemistry by BK Sharma, GOEL Publishing house 6. Textbook of Environmental Studies, by E. Bharucha, UGC universities Press 7. Environmental Studies by R. Rajagopalan, Oxford University Press 8. Environmental Pollution and Control by JF Peirce, RF Weiner, and PA Vesilind, Elsevier Science & Technology Book 9. Ecology by Mohan P. Arora, Hmalaya Publishing House 10. Fundamentals of Ecology by M.C. Dash
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	0	0	0	3
CO2	0	0	1	3
CO3	1	1	0	3
CO4	1	0	2	3
CO5	0	0	0	3



Avg.	0	0	1	3
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1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	3	1	0	1	3	2	2	2	2	1	1	2	3
CO5	3	1	0	1	3	2	2	2	2	1	1	2	3
Avg.	3	1	0	1	3	2	2	2	2	1	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



Teaching Scheme

Semester – V

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTFS511	Fire Service Operations	3	0	0	3	3	0	0	3	20	40	40	100	-	100
2	BTFS512	Safety Management II	3	0	0	3	3	0	0	3	20	40	40	100	-	100
3	BTFS513	First Aid & Basic Life Support	2	2	0	4	2	2	0	3	20	40	40	100	50	150
4	BTFS514	Hazardous Waste Management	3	0	0	3	3	0	0	3	20	40	40	100	-	100
5	BTFS515	Introduction to Fire Dynamics	3	2	0	5	3	2	0	4	20	40	40	100	50	150
6	BTFS516	Fire drills & Practical	0	4	0	4	0	4	0	2	-	-	-	-	50	50
7	AECC501	Disaster Risk Management	2	0	0	2	2	0	0	2	20	40	40	100	-	100
8	BTFS517	Industrial Internship	0	0	0	2	0	0	0	2	-	-	-	-	100	100
9	NPTEL NOC 01	NPTEL ONLINE COURSE	2	0	0	2	0	0	0	2	-	-	-	-	-	100
		Total				28				24						950

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester



COURSE CODE BTFS511	COURSE NAME Fire Service Operations	SEMESTER V
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Fire Drills & Practical
Course Category	Professional Core
Course focus	Employability
Rationale	The rationale behind fire service operations is to protect life, property, and the environment from the devastating effects of fires and other emergencies. Fire service operations are designed to provide a range of services aimed at preventing, mitigating, and responding to fire incidents and other emergencies effectively. The key rationales behind fire service operations are Life Safety, Property Protection, Environmental Stewardship, Fire Prevention and Education, Emergency Response Coordination, Training and Readiness, Community Service. Overall, the rationale behind fire service operations revolves around safeguarding life, protecting property, and preserving the environment. Through prevention, preparedness, and effective emergency response, fire service operations strive to minimize the impact of fires and emergencies on individuals and communities.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: To understand the role and organizational structure of fire services in the country 2: To provide fundamental understanding of fire service operations in terms of communication, mobilization, equipment, planning and strategies applied for responding to incidents 3: To understand the need for an incident command system to handle incidents effectively 4: To understand different fire phenomena experienced by fire fighters and common techniques employed at high-rise building fires 5: To familiarize students with operational firefighting and rescue tactics applied at common industrial incidents involving buildings, electrical systems and industrial plants

Course Content (Theory)	Weightage	Contact hours
Unit 1: Role, functions and organization of different Fire Services within the country and associated legislation. Understand the role of central and state governments, Gujarat state government setup and individual organizations for Fire service planning. Capabilities and infrastructure of	10%	5 hours



different Fire Services in the country. Fire Service hierarchy and ranks in Government of Gujarat, Municipal corporations – Organograms, Powers and responsibilities of various positions.		
Unit 2: Fire and emergency response – fire calls, communication and deployment procedure. Familiarization with communication equipment, Control room operations and mobilizing practices, Vehicle tracking and monitoring systems and radio operations and communication. Firefighting vehicles and equipment used by fire and emergency services: water tender, foam tender, DCP tender, water bowser, disaster/hazmat cum emergency rescue tender, crash fire tender, turn-table ladder tender, Rapid Intervention Vehicles (RIVs), hydraulic platform.	20%	10 hours
Unit 3: Importance of Incident Command System and operational environment, controlling risk and improving effectiveness of response, leadership in operation. Organization on the Incident ground, levels of command and roles of Fire service personnel at each level of command. Sectorization of incident and span of control concepts at incidents. Inter-agency liaison. Incident Risk Management – Introduction, Risk assessment in the Fire service, Generic risk assessment, dynamic risk assessment, managing risk, the tactical mode, responsibilities within tactical mode, analytical risk assessment.	20%	10 hours
Unit 4: Fire rescue service operational risk philosophy – risk assessment in fire service – managing the risk – tactical mode – announcement & recording the tactical mode – responsibilities – examples – analytical risk assessment – risk control measures – role of a safety officer – closing stages of an incident. Generic risk assessment of rescue operation from - confined spaces, collapsed structures, lift or escalators, transportation accidents, industrial fires, transportation involving hazardous chemical and aircraft accidents.	25%	10 hours
Unit 5: Introduction to conventional equipment used by Fire and Rescue Services (FRS) - Different types of ladders, extension ladder, turntable ladders, hydraulic platforms, fireman's axe, wrench, crowbar, tripod, rescue harness, pulleys, karabiners, infra-red camera and PPE their constructional features and applications. Fire service ropes – rope rescue, different types of knots & hitches and their applications in emergency. Advance hydraulic rescue equipment: Cutters, spreaders, hydraulic rams, High-pressure lifting bags, hydraulic jacks and wedges.	25%	10 hours

Instructional Method and Pedagogy: PPT, Video Presentation, Tutorial, Site Visits

Course Outcomes:

Blooms' Taxonomy

Blooms' Taxonomy Sub



	Domain	Domain
After successful completion of the above course, students will be able to: CO1: Remember the role and organizational structure of different fire services in the country CO2: Understand fire service operations in terms of communication, mobilization, equipment, planning and strategies applied for responding to incidents CO3: Understand incident command system and its role in handling major incidents effectively and safely CO4: Apply common rescue and firefighting techniques applied at high-rise building fires CO5: Evaluate firefighting tactics applied at common industrial incidents involving buildings, electrical systems, and plants	Cognitive	Remember Understand Understand Apply Evaluate

Learning Resources	
1.	Reference Books: 1. Fire Service Manual, Volume 1, Communications and Mobilizing, HMSO Publications 2. Fire Service Manual, Volume 2, Fire Service Operations, Compartment Fires and Tactical Ventilation, HMSO Publications. 3. Fire Service Manual, Volume 2, Fire Service Operations, Electricity, HMSO Publications 4. Fire Service Manual, Volume 2, Operational, Firefighting foam, HMSO Publications 5. Fire Service Manual, Volume 2, Fire Service Operations, Petrochemical Incidents, HMSO Publications 6. Fire Service Manual Volume 1 - Fire Service Technology Equipment and Media - Hydraulics_ Pumps and Water Supplies. 7. Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers. 8. Paul Spurgeon (2012) Fire service hydraulics and pump operations, Pennwell publications.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks



Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	0	2	0	0
CO2	0	2	0	0
CO3	1	3	0	0
CO4	1	2	0	0
CO5	2	3	0	0
Avg.	1	2	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	2	1	1	2	2	3	3	2	2	2	1	2	2
CO5	1	3	2	3	2	2	1	1	2	1	2	2	1
Avg.	2	1	1	1	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS512	COURSE NAME Safety Management II	SEMESTER V
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Safety Management I
Course Category	Professional Core
Course focus	Employability



Rationale	The rationale behind safety management is to prevent accidents, injuries, and other incidents that may harm individuals, damage property, or disrupt operations within an organization. Safety management systems are put in place to identify potential hazards, assess risks, and implement appropriate measures to control and mitigate those risks. The key aspects of the rationale behind safety management are Protecting human life and well-being , Reducing financial losses Ensuring legal compliance , Enhancing productivity and efficiency , Building trust and reputation , Continuous improvement . Overall, the rationale behind safety management is centered on protecting human life, minimizing financial losses, complying with legal requirements, improving productivity, enhancing reputation, and fostering a culture of safety and continuous improvement. By prioritizing safety, organizations create a secure and sustainable environment for their employees and stakeholders, leading to long-term success.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1: To familiarize with different accident indices for safety performance monitoring 2: To learn the basic concepts and techniques of safety management 3: To understand the application of different safety appraisal and control techniques in industry 4: To understand the fundamentals of accident investigation and reporting with its relevance in accident prevention 5: To become aware of total loss control concept and its components

Course Content (Theory)	Weightage	Contact hours
Unit 1: Types of accidents & performance rates, Definitions: Accidents - Reportable, Non-Reportable, Fatal, Non-Fatal. Near miss and Loss time accidents. Disabling injury, Accidents reportable under the Factories Act, ESI Act and Electricity Act. Safety Performance Rates: Frequency Rate, Severity Rate, Incidence Rate, Frequency Severity Index, Safety Score, Worked examples.	20%	9 hours
Unit 2: Types of Disablement: Temporary and Permanent Disablement, Partial and Total Disablement. Time Charges scheduled in Workmen's Compensation Act 1923, National and International Standards, Worked examples.	20%	9 hours
Unit 3: Theory: Accident and Incident Investigation, Reporting & analysis. Investigation - Philosophy, purpose, process and types of investigations, Identifying key factors and the immediate and basic causes. Corrective Action, Agencies investigating accident, Accident investigation Form, Methods of writing of accident investigation report. Reporting - reporting to authorities in statutory forms, writing reports, essential elements, reporting within prescribed time limits, reporting of dangerous occurrences. Analysis - Standard classification of factors associated with accident, methods of collating and tabulating data, record keeping.	20%	9 hours



Unit 4: Safety Appraisal & Control Techniques. Plant Safety Rules and Procedures, Safe operating procedures (SOP), Safety checklists, Safety work permits, Plant safety inspections, Safety sampling, Safety survey, Job safety analysis (JSA), Safety inventory system, Product safety, Safety tag system.	20%	9 hours
Unit 5: Total Loss Control & Prevention; concepts and application. Emphasis on safety procedures and practices, training and monitoring for reducing losses and improving safety. Loss control systems such as - Implementation of loss control policy, Assignment of duties and responsibilities, Review of claims data, Audits and inspections, Accident reporting and investigation, Communications development and review of emergency and contingency plan.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Chalk board, Tutorial

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand basic concept and techniques of safety management CO2: Understand different safety appraisal and control techniques in industry CO3: Understand concept of total loss control applied in industries CO4: Analyze different accident indices & systems applied for safety performance monitoring CO5: Evaluate accident investigation techniques, reporting formats and accident data analysis	Cognitive	Understand Understand Understand Analyse Evaluate

Learning Resources

1.	Reference Books: 1. K.U. Mistry, Handbook of Industrial Safety, Siddharth Prakashan, India 2. Manning Michael, So You are the Safety Director, 3rd Ed, Government Institutes Inc, 3. Ian Long, Simplicity in Safety Investigations: A Practitioner's Guide to Applying Safety Science 1st Edition 4. P.K. Singh, Accident & Incident Investigation: (with Training Guide & Report Writing) (HSE Book 1) 5. Heinrich H.W. Industrial Accident Prevention McGraw - Hill Company, New York, 1980. 6. Krishnan N.V. Safety Management in Industry Jaico Publishing House, Bombay, 1997.
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2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2
CO2	2	2	2	1
CO3	3	2	1	1
CO4	3	0	2	1
CO5	3	1	1	0
Avg.	3	1	2	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	1	2	2	2	1	2	2	1	2	1	1	2	1
CO5	1	3	2	3	2	2	1	1	2	1	2	2	1
Avg.	2	2	1	2	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	2	0	4	2	2	0	3

Course Pre-requisites	Basics of Occupational Health
Course Category	Professional Core
Course focus	Skill development
Rationale	The rationale behind first aid and basic life support (BLS) is to provide immediate and essential care to individuals who are injured, ill, or experiencing a life-threatening emergency. First aid and BLS aim to preserve life, prevent further harm, and promote recovery until professional medical help arrives. The key rationales behind first aid and basic life support are Preservation of Life, Prevention of Deterioration, Reduction of Pain and Suffering, Promotion of Recovery, Limitation of Further Injury, Provision of Psychological Support, Bridge to Advanced Medical Care, Community Empowerment. Overall, the rationale behind first aid and basic life support is to provide immediate and essential care in emergency situations, with the goals of preserving life, preventing deterioration, promoting recovery, and reducing pain and suffering. These interventions play a crucial role in increasing the chances of survival and minimizing the long-term impact of injuries or illnesses until professional medical assistance is available.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: To understand the basics of Occupational Health and Safety 2: To identify a range of common occupational illnesses and injuries 3: To prepare first aid procedure for different bodily injuries 4: To demonstrate skills to perform first aid for different bodily injuries 5: To describe management of human casualty in case of emergencies

Course Content (Theory)	Weightage	Contact hours
Unit 1:Theory: Introduction - What is First Aid, it's Aim, and Benefits, basics of the human body and its functions, role and responsibilities of first aider, types of emergencies. Initial assessment of the situation and victim, first aider's safety, physical fitness of the first aider.	20%	6 hours
Unit 2: Theory:First Aid – 1 Ingredients of a First Aid kit, types of dressings, types of bandages and their use for different types of injuries. First Aid treatment for: wounds, cuts, burns: chemical and electric, injuries to bones and joints: fracture of skull, spine, rib bone(s), arm & leg bone(s), finger(s), thigh bone, dislocation. Signs and symptoms of bleeding: Internal and external, First Aid and control of bleeding.	20%	6 hours



Unit 3: Theory: First Aid – 2 Basic Life support skills: ABC of First aid, CPR for cardiac arrest, first-aid for unconscious victims, victims of poisoning, victim with respiratory obstruction, choking. Antidotes. Introduction to Defibrillation: Basics of Automated External Defibrillator (AED), use of AED. Routes of entry, types of poisonous substances, types toxic and corrosive substances. Introduction to industry or job specific injuries or adverse health impacts.	20%	6 hours
Unit 4: Theory: First Aid – 3 Respiratory system: exposure to various chemicals and its symptoms, first aid treatment for victim of specific hazardous chemical substance exposure i.e. ammonia, chlorine, H ₂ S, etc. First aid to skin injuries and allergic reactions. Eye: First aid for chemical splash, flying objects, arc, heat radiation exposure, acute and chronic exposures. Management of victim of diarrhea and extreme heat or cold exposure.	20%	6 hours
Unit 5: Theory: Casualty management in emergencies: Mass Casualty Incident: Definitions, communications and incident management, triage and hierarchical approach. Search and Rescue Techniques during various incidents. Mental health support during and in the aftermath, teamwork during mass casualty incidents, challenges in casualty management.	20%	6 hours

List Of Practical	Weightage	Contact hours
1. Demonstrations of the human body and examination of functions such as pulse, breathing, movements of the chest and abdomen, movements of various joints of the body	20%	3 hours
2. Practical study of internal organs from the model of the human body.		
3. Demonstrate the types of bandages and their specific use for different types of injuries.	20%	3 hours
4. Practice first aid for burns, injury to head, fracture to different bone(s) or body parts, cut and control of bleeding		
5. Practice CPR, first-aid for unconscious victims and poisoning	20%	3 hours
6. Demonstration of AED		
7. Practice first aid treatment for victim of extreme heat or cold exposure, eye injuries and skin injuries.	20%	3 hours
8. Practice first aid treatment for respiratory system injuries.		
9. Demonstration of Lifting and moving of victims or casualties, use of stretcher.	20%	3 hours
10. Stretcher Drill		

Instructional Method and Pedagogy: PPT, Demonstration, Animated Videos, board, Notes.

Course Outcomes:	Blooms' Taxonomy	Blooms' Taxonomy Sub
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	Domain	Domain
After successful completion of the above course, students will be able to: CO1: Remember the terminologies of first aid and basic life support CO2: Understand the concept of occupational illnesses and injuries CO3: Apply first aid procedures for injuries CO4: Evaluate human casualty during emergencies	Cognitive	Remember Understand Apply Evaluate

Learning Resources	
1.	Reference Books: 1. B D Chaurasia (2020) Handbook Of General Anatomy, CBS; 6th edition. 2. L.G Gupta & Abhitabh Gupta (2012) First Aid, Jaypee Brothers. 3. Indian Red Cross Society, St John Ambulance Association First Aid Manual. 4. Dr. Rajeev Sharma, First Aid Guide, Diamond Books. 5. Angus Maciver (2015) The Illustrated First Aid in English, Hodder Education. 6. Drake (2014) Gray's Atlas of Anatomy, International Edition, Elsevier Health – US. 7. Agur and Dalley (2016) Grants Atlas of Anatomy, Wolters Kluwer India Pvt. Ltd. 8. Yoram Kluger, Federico Coccolini, Fausto Catena and Luca Ansaloni (2020) WSES Handbook of Mass Casualties Incidents Management, Springer Nature Switzerland. 9. Mauricio Lynn (2019) Disasters and Mass Casualty Incidents, Springer Nature Switzerland. 10. Jeanne MagerStellman (ed). Encyclopedia of occupational health and safety. (Four volumes). (Fourth edition). International Labour Office, Geneva.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks



Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	0	1	2	0
CO2	1	1	2	0
CO3	0	0	2	0
CO4	1	1	2	0
Avg.	1	1	2	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	2	1	1	2	2	3	3	2	2	2	1	2	2
CO4	1	3	2	3	2	2	1	1	2	1	2	2	1
Avg	2	2	1	2	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS514	COURSE NAME Hazardous Waste Management	SEMESTER V
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Teaching Scheme (Hours)	Teaching Credit
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Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2

Course Pre-requisites	Environmental Studies
Course Category	Professional Core
Course focus	Employability
Rationale	The rationale behind hazardous waste management is to protect human health, the environment, and future generations from the harmful effects of hazardous waste. Hazardous waste consists of materials that pose substantial risks to human health or the environment due to their toxic, flammable, corrosive, or reactive properties. The key rationales behind hazardous waste management are health and safety, Environmental Protection, Legal and Regulatory Compliance, Risk Reduction, Resource Conservation, Public Awareness and Education, Sustainable Development. Overall, the rationale behind hazardous waste management is rooted in the need to protect human health, the environment, and future generations from the risks and adverse impacts associated with hazardous waste. By implementing proper management practices, promoting awareness, and complying with regulations, the potential harm caused by hazardous waste can be minimized, and a sustainable and safe environment can be maintained.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: To recognize various types and sources of hazardous waste and problems involved with 2: To discuss the methods for the safe handling and transportation of Hazardous Waste 3: To distinguish the techniques and technology the supply, storage, use and transportation of hazardous substances 4: To differentiate the hazards associated with treatment, storage and disposal (TSD) of hazardous wastes 5: To interpret the regulations and laws describing various industrial and non-industrial hazardous waste

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to waste: types and sources of various waste, nature and characteristics. Global and national scenario of generation rates, potential of disease, nuisance in the society and other problems. The need for safe handling and transportation of hazardous waste, elements of integrated waste management, involvement of stakeholders in the process of waste management.	20%	6 hours
Unit 2: Hazardous Waste Management – 1: Objectives of HW processing, material separation and processing technologies. Packaging, labelling and transport of hazardous wastes, Physical, Chemical and	20%	6 hours



Biological treatment of hazardous waste. Bioremediation of hazardous waste, Management of nuclear waste and Radio-active waste.		
Unit 3: Hazardous Waste Management – 2: Electrical energy generation from solid waste (Fuel pellets, Refuse derived fuels), recycling, recovery of materials. Bio-medical waste: classification, sources, handling, transportation and disposal. E-waste: classification, methods of handling and disposal. Fly ash and hazardous dust: sources, composition and utilization. Plastic waste: sources, consequences and management.	20%	6 hours
Unit 4: Treatment, storage and disposal (TSD) of hazardous wastes: Collection and separation, Containers and its location. Storage of hazardous chemicals, temporary storage safety. Disposal methods: Sanitary land filling, Planning - Site selection, Design, Landfill Process, Closure of the landfill pit, Post closure monitoring. Other disposal methods like incineration and pyrolysis.	20%	6 hours
Unit 5: Hazardous Waste Management Regulations: Important features of and introduction to Indian legislation on handling and management of Hazardous waste viz. The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and The Hazardous Wastes (Management and Handling) Rules, 1989. Introduction of legislation related to Bio-medical waste transportation and disposal, handling and manufacturing of lead-acid batteries, radioactive waste management, plastic waste management and fly ash and hazardous dust waste management.	20%	6 hours

Instructional Method and Pedagogy: PPT, Video presentation, Site Visits, Case Studies

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember various types and sources of hazardous waste and problems involved with CO2: Understand methods for the safe handling and transportation of Hazardous Waste CO3: Apply techniques involved in the supply, storage, use and transportation of hazardous substances CO4: Evaluate hazards associated with treatment, storage and disposal of hazardous wastes CO5: Understand regulations and laws describing various industrial and non-industrial hazardous waste	Cognitive	Remember Understand Apply Evaluate Understand

Learning Resources



1.	Reference Books: - Charles A. Wentz (1995) Hazardous Waste Management, McGraw Hill, New York. - Michael D. Lagrega, Phillip L. Buckingham, Jeffrey C. Evans (1994) Hazardous Waste Management McGraw Hill, New York. - Gaynor W. Dawson, Basil W. Mercer (1986) “Hazardous Waste Management” Wiley Interscience, New York. - M.N. Rao, Razia Sultana, Sri Harsha Kota, Naresh Davergave, Anil Shah (2016) Solid and Hazardous Waste Management: Science and Engineering, Butterworth-Heinemann. - Marc J. Rogoff (2014) Solid Waste Recycling and Processing: Planning of Solid Waste Recycling Facilities and Programs, William Andrew. - RaffaelloCossu and Rainer Stegmann (2019) Solid Waste Landfilling: Concepts, Processes, Technologies, Elsevier - Marc J. Rogoff and Francois Screve (2012) Waste-to-Energy: Technologies and Project Implementation, William Andrew. S. C. Bhatia (2007) Solid and Hazardous Waste Management, Atlantic publishers. - Himadri Panda (2019) Biomedical Waste: Management, Recycling And Applications, Discovery Publishing House Pvt Ltd. - AlfonsBuekens (2013) Incineration Technologies (Springer Briefs in Applied Sciences and Technology), Springer; 2013th edition
2.	Journals & Periodicals: - Waste Management, Elsevier Ltd - Journal of Hazardous Materials, Elsevier - Nuclear Engineering and Design, Elsevier BV
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										



	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2
CO2	2	2	0	1
CO3	1	1	1	2
CO4	2	1	1	2
CO5	0	0	0	2
Avg.	1	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO!2
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	2	1	1	2	2	3	3	2	2	2	1	2	2
CO4	1	3	2	3	2	2	1	1	2	1	2	2	1
CO5	3	1	0	1	3	2	2	2	2	1	1	2	3
Avg.	2	1	1	1	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS515	COURSE NAME Introduction to Fire Dynamics	SEMESTER V
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	Building Fire Prevention & Protection Measures
Course Category	Professional Core
Course focus	Skill development
Rationale	The rationale behind the introduction to fire dynamics is to provide a fundamental understanding of the science and behavior of fires. Fire dynamics is the study of how fires start, develop, and spread, and it is essential for firefighters, fire investigators, fire safety engineers, and other professionals involved in fire prevention, suppression, and mitigation. The key rationales behind the introduction to fire dynamics are fire Behavior Prediction, Firefighter Safety, Fire Investigation, Fire Protection Engineering, Fire Prevention, Firefighter Training and Tactics, Research and Innovation. Overall, the rationale behind the introduction to fire dynamics is to provide individuals with a solid foundation of knowledge about the science and behavior of fires. This knowledge is critical for effective firefighting, fire investigation, fire protection engineering, fire



	prevention, and advancing the field of fire science and engineering through research and innovation.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1: To provide students with quantitative understanding of fire ignition, growth and behavior, in terms of chemical thermodynamics, kinetics, and heat and mass transfer principles 2: To understand different ignition and combustion mechanisms, behavior of solid, liquid and gaseous fuels involved in combustion 3: To understand the impact of fire on occupants and materials in scientific terms, and be able to assess the same 4: To carry out calculations with respect to fire growth, smoke generation and spread, and toxicity/visibility effects of smoke

Course Content (Theory)	Weightage	Contact hours
Unit 1:Theory: Fundamentals of heat transfer mechanisms in fluids and solids, fundamentals of combustion including material and energy balances, chemical thermodynamics, kinetics, premixed and diffusive burning. Advanced topics in the theory of combustion, flame propagation, efficiency of combustion, and the physico- chemical properties of combustible material.	20%	9 hours
Unit 2: Theory: Steady state heat conduction with and without heat generation, thermal insulation, selection criteria, critical and optimum thickness determination, extended surfaces and unsteady state heat transfer. Thermochemistry, Conservation Equations, Combustion Chemistry, Adiabatic Flame Temperatures	20%	9 hours
Unit 3: Theory: Ignition in solid, liquid and gaseous fuels, and fire spread. Fire Characteristics of gaseous combustibles, types for gaseous flames, fire characteristics of liquids combustible; category of liquid fire, burning rate of liquid pools, flame spread rate, fire Characteristics of solid combustible: gasification, ignition, charring &melting, spontaneous ignition.	20%	9 hours
Unit 4: Theory: Heat of combustion of materials, heat release rate in fires, flashover phenomenon, plumes, flame height, smoke generation and effluents in smoke, along with assessment methods and calculations. Estimating effects of smoke on visibility and toxicity based on material properties and combustion environment.	20%	9 hours
Unit 5: Theory: Premix & diffusion flames, heat transfer from fires to surrounding materials and structure, conductive, convective and radioactive heat transfer in fires, important properties of materials with respect to heat transfer during fires and calculations.	20%	9 hours

List Of Practical	Weightage	Contact
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		hours
1. To study steady state conduction experiment, heat transfer in composite materials,	20%	6 hours
2. Convective heat transfer experiment using forced and natural convection.		
3. Radioactive heat transfer. Understanding importance of insulation.		
4. Understanding the ignition & combustion properties of various solid	20%	6 hours
5. Find the calorific value		
6. Find the flash & fire points		
7. Understanding Pool fires & spill fires	20%	6 hours
8. Understanding ignition of flammable & air mixtures		
9. Practical related to liquid pool fires, mass loss of solid fuel fires.		
10. Practical related to Heat release rate	20%	6 hours
11. Understanding smoke dynamics		
12. Properties of materials with respect to heat transfer during fires	20%	6 hours
13. Calculations of heat properties of composite materials, metals, alloys and insulators.		

Instructional Method and Pedagogy: PPT, Video Presentation, Demonstration

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand fire ignition and growth, using application of thermodynamics, kinetics, heat and mass transfer principles CO2: Understand ignition and combustion mechanisms, and the behavior of solid, liquid and gaseous fuels involved in combustion CO3: Analyze impact of fire on occupants and materials in scientific terms, and able to assess the same CO4: Analyze fire growth, heat and smoke generation, energy transfer during fires, and smoke visibility and toxicity effects	Cognitive	Understand Understand Analyse Analyse

Learning Resources

1.	Reference Books: 1. Donald Q. Kern; Process Heat Transfer; Tata McGraw Hill. 2. Alan J. Chapman; Heat Transfer; Collier McMillan. 3. Rao Y.V.C; Heat Transfer; PHI 4. Quintiere, J. G., Fundamentals of Fire Phenomena, John Wiley & Sons, Chichester, UK, 2006.
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	5. Drysdale D, An Introduction to Fire Dynamics, 3rd Edition, John Wiley & Sons 6. iNenno, P.J. (Ed.), SFPE Handbbok of Fire Protection Engineering (4th Edition), NFPA, Quincy, MA,2008,
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks												
Theory: Mid semester Marks	20 marks												
Theory: End Semester Marks	40 marks												
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks		
Attendance	05 marks												
MCQs	10 marks												
Open Book Assignment	15 marks												
Open Book Assignment	10 marks												
Total	40 Marks												
Practical Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>Practical Exam</td><td>20 marks</td></tr> <tr> <td>Viva</td><td>10 marks</td></tr> <tr> <td>Journal</td><td>10 marks</td></tr> <tr> <td>Discipline</td><td>05 marks</td></tr> <tr> <td>Total</td><td>50 Marks</td></tr> </table>	Attendance	05 marks	Practical Exam	20 marks	Viva	10 marks	Journal	10 marks	Discipline	05 marks	Total	50 Marks
Attendance	05 marks												
Practical Exam	20 marks												
Viva	10 marks												
Journal	10 marks												
Discipline	05 marks												
Total	50 Marks												

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	2	0	0
CO3	2	2	1	1
CO4	1	2	1	1
Avg.	1	2	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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B.Tech Fire &EHS

Course Curriculum

Academic Year 2022-23

CO1	3	1	0	1	3	2	2	2	2	1	1	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	1	2	2	2	1	2	2	1	2	1	1	2	1
CO4	1	2	2	2	1	2	2	1	2	1	1	2	1
Avg.	2	2	1	2	2	2	2	2	2	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE AECC501	COURSE NAME Disaster Risk Management	SEMESTER V
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2

Course Pre-requisites	-
Course Category	Ability Enhancement Compulsory Courses
Course focus	Skill development
Rationale	The rationale behind disaster risk management is to reduce the impact of disasters on human lives, communities, and economies by understanding, mitigating, and managing the risks associated with natural and man-made hazards. Disaster risk management aims to enhance resilience, promote sustainable development, and protect vulnerable populations. The key rationales behind disaster risk management are Risk Reduction, Humanitarian Imperative, Sustainable Development, Preparedness and Response, Community Engagement and Participation, Knowledge and Information Sharing, International Cooperation. Overall, the rationale behind disaster risk management is to minimize the impacts of disasters by reducing risks, enhancing resilience, protecting lives and livelihoods, and promoting sustainable development. By adopting a proactive and holistic approach, disaster risk management seeks to create safer, more resilient, and sustainable communities that are better equipped to withstand and recover from the adverse effects of hazards.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To gain knowledge on different types of disaster 2: To introduce types of disasters with case studies and create awareness 3: To introduce various disaster management framework and strategies adopted at national and international levels 4: To study the effective use of science for mitigating disasters 5: To study case study of various famous disasters

Course Content (Theory)	Weightage	Contact hours
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Unit 1:Introduction to Disasters: Understanding the Concepts and Definitions of Disaster, Hazard, Vulnerability Risk, Capacity – Disaster and Development, and Disaster Management. Fundamental of Disasters-Types, Trends, Causes, Consequences and Control: Geological Disasters, Hydro- Meteorological Disasters, Biological Disasters, Technological Disasters, and Man-made Disasters. Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.	20%	6 hours
Unit 2:Disaster Management Cycle and Framework: Paradigm Shift in Disaster Management, Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, Zonation, Microdonation, Prevention and Mitigation of Disasters, Early Warning System, Preparedness, Capacity Development; Awareness, During Disaster – Evacuation – Disaster Communication – Search and Rescue, Emergency Operation Centre –Incident Command System – Relief and Rehabilitation. Post-disaster Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action, Sendai framework.	20%	6 hours
Unit 3:Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster, Management Act 2005 – Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non- Government and Inter-Governmental Agencies. Disaster Management Act in relation to COVID-19 pandemic.	20%	6 hours
Unit 4:Role of Science and Technology in Disaster Management: Geo-informatics in Disaster Management (RS, GIS, GPS and RS), Disaster Communication System (Early Warning and Its Dissemination), Land, Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non-Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.	20%	6 hours
Unit 5:Disaster Case Studies: Various Case Studies on Disaster and Development, Disaster Prevention and Control, Risk Analysis and Management. Case study relating to COVID -19 to be explored.	20%	6 hours

Instructional Method and Pedagogy: PPT, Case Studies, Tutorial videos.

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember terminologies and concept of disasters CO2: Understand framework and concept of disaster management cycle CO3: Understand guidelines and policies of disaster	Cognitive	Remember Understand Understand



management in India

CO4: **Understand** role of science and technology in disaster managementCO5: **Evaluate** various disaster case studiesUnderstand
Evaluate**Learning Resources**

1.	Reference Books: 1. Alexander, D., Natural Disasters, Kluwer Academic London. 2. Asthana, N. C., Asthana P., Disaster Management, Aavishkar Publishers. 3. Carter, N., Disaster Management: A Disaster Manager's Handbook, Asian Development Bank. 4. Collins, A.E., Disaster and Development, Routledge. 5. Coppola, D.P., Introduction to International Disaster Management, 2nd Edition, Elsevier Science. 6. Goyal, S.L., Encyclopedia of Disaster Management (Vols. 1-3), Deep &Deeep, New Delhi 7. Gupta, A.K., Nair, S.S., Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi. 8. Ibrahimbegovic, A., Zlatar, M., Damage Assessment and Reconstruction after War or Natural Disaster, Springer. 9. Menshikov, V.A., Perminov, A.N., Urlichich, Y.M., Global Aerospace Monitoring and Disaster 10. Modh, S., Introduction to Disaster Management, Macmillian Publishers India
2.	Journals & Periodicals: 1. International Journal of Disaster Risk Reduction 2. Disaster Prevention and Management
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory:Mid semester Marks	20 marks
Theory:End Semester Marks	40 marks



Theory:Continuous Evaluation Component Marks		
	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2
CO2	2	1	1	1
CO3	2	1	1	1
CO4	2	2	0	1
CO5	2	2	1	2
Avg.	2	2	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	1	2	1	1	0	0	0	2	3
CO2	3	1	0	1	3	2	2	2	2	1	1	2	3
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	3	1	0	1	3	2	2	2	2	1	1	2	3
CO5	1	3	2	3	2	2	1	1	2	1	2	2	1
Avg.	3	1	0	1	2	2	2	2	2	1	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



**Teaching Scheme****Semester – VI**

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTFS601	Safety Engineering	3	0	0	3	3	0	0	3	20	40	40	100	-	100
2	BTFS602	Fire Protection Systems	4	0	0	4	4	0	0	4	20	40	40	100	-	100
3	BTFS603	Industrial Hygiene & Toxicology	3	2	0	5	3	2	0	4	20	40	40	100	50	150
4	BTFS604	Environmental Pollution & Control Measures	3	2	0	5	3	2	0	4	20	40	40	100	50	150
5	BTFS605	Professional Elective - I	3	0	0	3	3	0	0	3	20	40	40	100	-	100
6	BTFS606	Fire drills & Practical	0	4	0	4	0	4	0	2	-	-	-	-	50	150
7	BTOE (*)	Open Elective	3	0	0	3	3	0	0	3	20	40	40	100	-	100
8	AECC601	Indian Constitution	2	0	0	2	2	0	0	2	20	40	40	100	-	100
9	SECC601	Industrial Internship	0	0	0	2	0	0	0	2	-	-	-	-	100	100
Total						31				27						950

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component,ES - End Semester



COURSE CODE BTFS601	COURSE NAME Safety Engineering	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Safety Management II
Course Category	Professional Core
Course focus	Employability
Rationale	The rationale behind safety engineering is to prevent accidents, injuries and fatalities by systematically identifying and managing hazards in various industries and environments. Safety engineering applies scientific and engineering principles to design, implement, and maintain safe systems, processes, and equipment. The key rationales behind safety engineering are Protection of Human Life and Health, Accident Prevention, Compliance with Regulations and Standards, Mitigation of Occupational Hazards, Systematic Risk Management, Designing and Evaluating Safety Systems, Emergency Preparedness and Response. Overall, the rationale behind safety engineering is to prevent accidents, protect human life and health, and create safe working environments. Safety engineers apply scientific and engineering principles to identify, assess, and control hazards, ensuring compliance with regulations and standards. By designing and implementing safety systems, conducting risk assessments, and promoting a culture of safety, safety engineers contribute to accident prevention and the well-being of individuals in various industries and environments.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives	To enable the student to: 1: To comprehend principles and benefits of safety engineering 2: To understand various work equipments 3: To learn the importance of material handling 4: To acquire knowledge on working in different environment 5: To learn the basics of electrical safety and its need

Course Content (Theory)	Weightage	Contact hours
Unit 1: Plant Design and Layout: Citing Criteria: - General and Environmental guidelines. Meteorological aspects. - Separation distances- Need for Planning and follow-up - Plant Layout and Design. General principles for factory building, -plant & equipment layout and fire protection- Statutory provisions - Housekeeping and its effects on safety- Indicators of bad housekeeping. - Typical accidents due to bad	20%	9 hours



housekeeping- Benefits of good housekeeping- Management of good housekeeping. Use of Colour as an aid for good housekeeping -Cleaning Methods- Employee assignment - Inspections and Checklists. - Role of Preventive and Productive Maintenance for Housekeeping. - Concept of “Five S”.		
Unit 2: Work Equipments: Different work equipment - Suitability - Prevention of access to dangerous parts of machinery - restricting use - information, instruction and training - maintenance requirements - equipment controls and environmental factors - responsibilities of users. Handheld tools, portable power tools, mechanical & non-mechanical tools – hazards and its control - Inspection, maintenance and repair of tools. Principles of machine guarding - Guarding of different types of machinery including special precautions-For wood working, rubber, centrifugal machines, and paper mill machinery - Built-in-safety devices - Maintenance and repairs of guards- Zero Mechanical State (ZMS) - Incidental safety devices and tools.	20%	9 hours
Unit 3: Material Handling: Kinetics of manual handling - Maximum loads that could be lifted or carried -Safe method and procedure for lifting and carrying of objects of-different shapes, size and weight. Safe use of accessories for manual handling. Storage of materials. Safety in stacking and un-stacking, floor loading conditions - Common Types of Manual Handling Injury - Assessing Manual Handling Risks - Avoiding or Minimizing Manual Handling Risks. Mechanical handling: Lifting machinery, lifts and hoists. Safety aspects in design and construction, testing, use and care, signaling, inspection and maintenance. Hazards and Controls for Manually Operated Load Handling Equipment - Powered Load Handling Equipment - Requirements for Safe Lifting Operations - Requirements for Periodic Examination of Lifting Equipment.	20%	9 hours
Unit 4: Working in Different Environment: Working at Height-examples - hazards involved - avoiding work at height – prevention of falls and falling materials - emergency rescue - minimizing distance and consequences of a fall - head protection - safe working practices for access equipment - Inspection of access equipment incidence and seriousness of fall accidents. Other safety requirements-while working at heights -Safety belts-their types, use and limitations. Whole body harness -with double lifelines - Fall arrestor device. Working Underground -Hazards and controls. Confined space – hazards & associated risk – communication – supervision. Slips & trips, Lone working – factors – preventive measures	20%	9 hours
Unit 5: Electrical Safety: Protective devices in electrical circuits such as fuses, circuit breakers - Safety and fire hazards associated with power generating, transmission, distribution systems and protective systems - Substation equipment’s, different types of transformers – their working principles and applications, associated faults and hazards, protection systems and devices - Internal distribution systems, protection devices and systems required - Concept of hazardous area classification likely to have	20%	9 hours



hazardous atmospheres and different electrical equipment employed in hazardous areas and their suitability.

Instructional Method and Pedagogy:

PPT, Video Presentation

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Remember need and benefits of safety engineering CO2 Understand various work equipments and its suitability CO3 Understand general safety in material handling CO4 Evaluate working in various environment CO5 Evaluate electrical hazards and its protection measures	Cognitive	Remember Understand Understand Evaluate Evaluate

Learning Resources

1.	Reference Books: 1. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York. 2. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann. 3. Safety at Work by John Ridley 4. J. Maxwell Adams, Electrical Safety a Guide to the Causes and Prevention of Electrical Hazards, IEE Power series-19. 5. Handbook of Industrial Safety by K.U. Mistry 6. Safety and Good housekeeping by NPC, New Delhi 7. Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva 8. Accident Prevention Manual for Industrial Operations, National Safety Council, 425, North Michigan Ave, Chicago, Illinois, USA.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks



Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	2	0	2	0
CO3	2	2	1	0
CO4	3	1	1	1
CO5	3	2	1	1
Avg.	2	1	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	1	1	2	2	1	1	0	0	2	2
CO2	3	1	0	0	2	2	2	3	0	1	3	3	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3	3
CO4	2	2	0	3	2	3	2	3	1	1	1	3	2
CO5	2	2	0	3	2	3	2	3	1	1	1	3	2
Avg.	2	1	0	1	2	2	2	3	1	1	2	3	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS602	COURSE NAME Fire Protection Systems	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
4	0	0	4	4	0	0	4

Course Pre-requisites	Building Fire Prevention & Protection Measures
Course Category	Professional Core



Course focus	Employability
Rationale	The rationale behind fire protection systems is to prevent, detect, control and mitigate the risk of fires. Fire protection systems are designed and implemented to safeguard life, property, and the environment from the devastating effects of fires. These systems include various components such as fire alarms, sprinkler systems, fire extinguishers, smoke detectors, and fire suppression systems. Some key rationales behind fire protection systems are Life Safety, Property Protection, Business Continuity, Compliance with Regulations and Standards, Early Fire Detection, Fire Suppression and Control, Risk Mitigation. Overall, the rationale behind fire protection systems is to prevent, detect, control, and mitigate the risks posed by fires. These systems prioritize the safety of occupants, protect property, support business continuity, and ensure compliance with regulations. By incorporating various components and strategies, fire protection systems play a critical role in reducing the devastating impacts of fires and enhancing overall safety in buildings and occupancies.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1: To identify the need, suitability and effectiveness of commonly installed portable and fixed fire protection systems 2: To design water-based fire protection systems for various occupancies and carry out basic design calculations according to the regulations 3: To critically analyze the type of facility and fire load for the selection of appropriate fire protection system 4: To understand the importance of testing and maintenance in effective functioning of fire protection systems

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to fire extinguishing medias, its physical properties which make it suitable for fire protection. Classification and suitability of water-based fire protection systems i.e., Fire water hydrant system, rising mains, sprinkler systems, high & medium velocity water spray systems, water mist systems and foam systems. Introduction to types of Detection and alarm systems. Overview of relevant codes and standards: NBC Part 4, Indian Standards, OISD standards, NFPA, British Standards, Eurocode.	10%	6 hours
Unit 2: Portable Fire Extinguishers: Classification of extinguishers and suitability of extinguishers for various fire, occupancy. Classification of Hazards, Fire Extinguisher Size and Placement, selection of location, selection of fire extinguishers, maintenance of fire extinguishers and Safety Precautions for Maintenance, Indian standards for different types of fire extinguishers.	25%	15 hours
Unit 3: Fire Hydrant systems – Introduction to various important terms – water tank, fire water supply, fire pumps, risers, valves, fire service inlet. Types of fire water storage arrangements. Firewater Pumps, types and	25%	15 hours



arrangements. Dry and Wet riser arrangement, external fire hydrant system. Hose-reels, monitors, fire brigade inlets and other accessories based on hazard category and design codes and guidelines.		
Unit 4: Main elements of a sprinkler network, types of sprinklers system and characteristics - end-side with central feed, end-centre with centre feed end feed, end-centre with end feed, end-centre with centre feed end feed, design guidelines for sprinkler systems including pumping systems, valves and sprinkler types and rating. Introduction to Medium and High velocity water spray systems (MVWS & HVWS), their suitability, design guidelines and installation requirements as per relevant design and installation codes.	25%	15 hours
Unit 5: Fire Alarm System: Fire Alarm System Basics, Types of signals, components of a fire alarm system, introduction to Fire Detectors and Flame detectors, Detector Placement and basic calculations. Introduction to Manual Call Point (MCP), requirements to install MCP and relevant codes and standards. Types of fire alarm systems, requirement to install Fire Alarm.	15%	9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Chalk board

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Understand water-based fire protection systems currently installed in industry and buildings, based on occupancy and/or specific hazards CO2 Evaluate design calculations for water-based fire protection systems and prepare basic layouts and specifications for different systems CO3 Evaluate code requirements for different water-based fire protection system CO4 Apply effective functioning of fire protection systems and be able to identify important ITM requirements for water-based systems	Cognitive	Understand Evaluate Evaluate Apply

Learning Resources

1.	Reference Books: 1. Arthur E. Cote, Fire Protection Handbook, Volume 1, Section-15 & 16, NFPA, USA
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	2. Fire Service Manual, Volume 3, Fire Safety, Fire Protection of Buildings, HMSO Books 3. Relevant IS codes: IS:13039-Fire Hydrant System, IS:15105 – Sprinkler Systems, IS:15301 – Fire Pumps, IS:15325 – Water Spray Systems 4. Robert M Gagnon, Designer’s Guide to Automatic Sprinkler Systems, 5. Fire Service Manuals U.K. 6. NFPA codes - 13-Sprinkler Systems, 14-Standpipe systems, 15-Water spray systems, 20-Fire Pumps, 22-Water Tanks for Fire Protection, 24-Private Fire Service Mains, 25-ITM of Water based Fire Protection systems
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1
CO2	1	3	0	0
CO3	1	2	0	1
CO4	1	2	0	1
Avg.	1	3	0	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3	2
CO3	2	2	0	3	2	3	2	3	1	1	1	3	2



B.Tech Fire &EHS

Course Curriculum

Academic Year 2022-23

CO4	3	2	0	1	3	2	2	2	1	1	1	2	3
Avg.	3	2	0	2	2	3	2	3	1	1	2	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS603	COURSE NAME Industrial hygiene and Toxicology	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	2	0	4

Course Pre-requisites	Basics of Occupational Health
Course Category	Professional Core
Course focus	Employability
Rationale	The rationale behind industrial hygiene and toxicology is to identify, assess, and control the potential health hazards in the workplace and the environment. Industrial hygiene focuses on the recognition, evaluation, and control of physical, chemical, biological, and ergonomic hazards that can arise in industrial and occupational settings. Toxicology, on the other hand, studies the adverse effects of chemical, physical, and biological agents on living organisms. Some key rationales behind industrial hygiene and toxicology are Worker Health and Safety, Hazard Identification and Risk Assessment, Compliance with Regulations and Standards, Exposure Control and Prevention, Hazard Communication and Education, Environmental Protection, Scientific Knowledge and Research. Overall, the rationale behind industrial hygiene and toxicology is to safeguard the health and well-being of workers and protect the environment. These disciplines focus on identifying, assessing, and controlling workplace hazards, ensuring compliance with regulations, and promoting effective risk management strategies. By utilizing scientific knowledge, conducting research, and implementing appropriate control measures, industrial hygiene and toxicology professionals contribute to creating healthier and safer workplaces for individuals and the broader community.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1. To comprehend basics, principles and benefits of Industrial Hygiene 2. To state the significant factors in the process of workplace monitoring 3. To evaluate the workplace area sampling techniques and principles of analytical instruments 4. To understand various toxic materials based on their physical states and potential adverse effects on human organs/body



5. To distinguish the potential mechanisms of adverse effects of toxic substances that contact and/or enter the body because of occupational exposures

Course Content (Theory)	Weightage	Contact hours
Unit 1: Industrial Hygiene: Prospect, Rationale for Industrial Hygiene Practice, workplace stressors for Industrial Hygiene. Difference between industrial hygiene and occupational health, Work co-ordination between industrial hygienist, safety officer and factory medical officer for the purpose of safety, hygiene & health. Benefits and scope of Industrial Hygiene in different workplace, role and responsibilities of Industrial Hygienist.	20%	9 hours
Unit 2: Workplace Air Monitoring: Occupational environmental limits: Threshold Limit Values for Chemical Substances and Physical Agents. Industrial Hygiene Monitoring: Instantaneous or Real-Time Sampling, Integrated or Continuous Sampling, Personal Sampling, Area Sampling. Sampling strategy: Pattern of exposure, Sampling for Estimation of Average Exposure. Calculations and working problems related to Vapor Pressure, tank and room purging	20%	9 hours
Unit 3: Ventilation as hazard control: Ventilation: Ventilation systems - purpose of ventilation-general principles ventilation requirements. Physiological and comfort level. Natural ventilation - Mechanical ventilation - Ventilation measuring instruments. Fundamentals of hood and duct designs. Standards on ventilation. Process ventilation – Dilution and Local Exhaust Ventilation (LEV). Industrial Air Conditioning. - Testing and Maintenance of ventilation systems, Ventilation designing concept with calculations. Other methods for control of hazards at workplace: Elimination, Substitution, Administrative Control, Engineering control and PPEs- RPES	20%	9 hours
Unit 4: Introduction to Toxicology: Aim, definition: toxicity, fumes, mist, smoke, dust, vapour etc. History of Toxicology. Routes of entry into the human body, dose response curve. Absorption, Distribution, Metabolism, Excretion (ADME), Site of action - local or systemic effects, Acute or chronic effect, Reversible or Irreversible effects. LD50, LC50 and HD50. Concept of Biological Exposure Indices (BEI). Risk extrapolation.	20%	9 hours
Unit 5: Effects of toxicity: Toxicity of metals: Aluminium, Arsenic, Cadmium, Beryllium, Chromium, Lead, Lithium, Mercury, Uranium, Zinc. Toxicity of gases, vapours and particulates. Nuclear toxicity. Systemic toxicology, Occupational respiratory diseases, skin diseases and target organ toxicology. Occupational Human Health Risk Assessment and Environmental Risk Assessment.	20%	9 hours



List Of Practical	Weightage	Contact hours
1. Measurement of intensity of illumination using lux level meter	20%	6 hours
2. Measurement of workplace noise using sound level meter		
3. Measurement of velocity of air using Anemometer	20%	6 hours
4. Measurement of heat stress using Wet Bulb Globe Temperature	20%	6 hours
5. Measurement of ionizing radiations using dosimeter		
6. Measurement of electromagnetic field using electromagnetic field meter		
7. Measurement of impurities in the workplace using air sampling pump	20%	6 hours
8. Measurement of toxic gases using dragger pump	20%	6 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Demonstration

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Understand principles and benefits of Industrial Hygiene CO2 Evaluate the significant factors in the process of workplace monitoring CO3 Apply sampling techniques and principles of analytical instruments CO4 Evaluate toxic materials based on their physical states and potential adverse effects on human organs/body CO5 Evaluate potential mechanisms of adverse effects of toxic substances that contact and/or enter the body as a result of occupational exposures	Cognitive	Understand Evaluate Apply Evaluate Evaluate

Learning Resources

1.	Reference Books: 1. M.H. Fulekar (2020) Industrial Hygiene and Chemical Safety, Wiley India 2. S. K. Haldar (2017) Industrial And Occupational Health, CBS. 3. Raja Sekhar Mamillapalli and Visweswara Rao (2021) Occupational Health and Hygiene in Industries, PharmaMed Press / BSP Books. 4. Phillip L. Williams, James L. Burson () Industrial Toxicology: Safety and Health Applications in the Workplace, Van Nostrand Reinhold. 5. Ronald Scott (1997) Basic Concepts: Industrial Hygiene, CRC Press.
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	6. Barbara A. Plog (2002) Fundamentals of Industrial Hygiene Fifth Edition; NSC. 7. ILO (2012) Encyclopedia of Occupational Health and Safety, ILO (Volume 1 -4): https://www.iloencyclopaedia.org/ 8. Klaassen, Curtis D. (2013) Casarett and Doull's Toxicology: The Basic Science of Poisons (Casarett&Doull's Toxicology) 8th Edition, McGraw-Hill Professional Publication. 9. Peter Baxter, Anne Cockcroft, Malcolm Harrington (2011) Hunter's Diseases of Occupations, Hodder Arnold; Tenth edition.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks												
Theory: Mid semester Marks	20 marks												
Theory: End Semester Marks	40 marks												
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks		
Attendance	05 marks												
MCQs	10 marks												
Open Book Assignment	15 marks												
Open Book Assignment	10 marks												
Total	40 Marks												
Practical Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>Practical Exam</td><td>20 marks</td></tr> <tr> <td>Viva</td><td>10 marks</td></tr> <tr> <td>Journal</td><td>10 marks</td></tr> <tr> <td>Discipline</td><td>05 marks</td></tr> <tr> <td>Total</td><td>50 Marks</td></tr> </table>	Attendance	05 marks	Practical Exam	20 marks	Viva	10 marks	Journal	10 marks	Discipline	05 marks	Total	50 Marks
Attendance	05 marks												
Practical Exam	20 marks												
Viva	10 marks												
Journal	10 marks												
Discipline	05 marks												
Total	50 Marks												

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	0	2	1
CO2	2	0	2	2
CO3	0	1	2	2



CO4	0	1	3	1
CO5	1	0	3	1
Avg.	1	0	2	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3	2
CO3	3	2	0	1	3	2	2	2	1	1	1	2	3
CO4	2	2	0	3	2	3	2	3	1	1	1	3	2
CO5	2	2	0	3	2	3	2	3	1	1	1	3	2
Avg.	2	2	0	2	2	3	2	3	1	1	1	3	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS604	COURSE NAME Environmental Pollution and Control Measures	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	1	0	4

Course Pre-requisites	Hazardous Waste Management
Course Category	Professional Core
Course focus	Skill development
Rationale	The rationale behind environmental pollution control measures is to protect the natural environment and human health from the adverse effects of pollution. Environmental pollution refers to the introduction of harmful contaminants into the environment, such as air, water, and soil, which can have detrimental effects on ecosystems, biodiversity, and human well-being. Environmental pollution control measures aim to reduce or eliminate pollution sources, mitigate the impacts of pollution, and promote sustainable environmental practices. The key rationales behind environmental pollution control measures are Protection of Ecosystems and Biodiversity, Preservation of Human Health, Compliance with Regulations and Standards, Sustainable Resource Management, Mitigation of Climate Change, Public Awareness and Education, Collaboration and International Cooperation. Overall, the rationale behind environmental pollution control measures is to protect the environment, preserve biodiversity, and safeguard human health. These measures aim to reduce pollution sources, mitigate the impacts of pollution, and promote sustainable resource management.



	practices. By implementing pollution control measures, individuals, organizations, and governments can contribute to a cleaner and healthier environment for current and future generations.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1: To understand terminologies in the field of environmental pollution and its control 2: To identify and discuss various sources and effects environmental pollutants 3: To illustrate how various pollutants, deteriorate the purity of environment 4: To propose control and management of sources of environmental pollution 5: To interpret several standards and regulations to assess and manage quality of environment

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to Environmental Pollution: Definitions of Water Pollution, Air Pollution, Noise Pollution, Solid Waste, Bio-medical Waste, E-waste. Sources of pollution: Domestic and Industrial. Types of pollutants: Classification of water pollutants, Sources of common air pollutants like PM _x , SO _x , NO _x , Types of soil pollutants. Effects of pollution on environment and humans.	20%	6 hours
Unit 2: Water pollution and its control: Physical, chemical and biological characteristics of wastewater. Introduction to Thermal pollution and Oil pollution: Sources, consequences and control. Wastewater treatment: Primary treatment, secondary treatment, Advanced or tertiary wastewater treatment, and sludge treatment and disposal	20%	6 hours
Unit 3: Air pollution and its control: Introduction to Air pollutants and their effects, acid rain, photochemical smog, particulates. Air quality monitoring: Introduction to AQI, Sampling and analysis of stack gases and ambient air, dispersion of pollutants in the atmosphere. Control and management: Control of Particulates, Control of Sulphur Oxides, Control of Nitrogen Oxides, Control of VOCs.	20%	6 hours
Unit 4: Industrial Solid Waste Management: Characteristics, Storage, Transportation, Treatment techniques of Hazardous Solid Waste. Methods of industrial solid waste treatment and disposal - Construction and operation of secured landfill, types of liner system, incineration or pyrolysis, recycling and reuse of solid waste. Introduction to Incinerable Solid Waste, Biomedical Waste Management, E-Waste Management, Plastics Waste Management.	20%	6 hours
Unit 5: Classification of water quality parameter Standards: drinking water quality standards, effluent disposal standards. Air quality and emission standards. Hazardous Waste (Management, Handling & Transboundary Movement) Rules. Introduction to Indian Standards/regulations for Noise Pollution control, Bio-medical waste management and E-waste management.	20%	6 hours



List Of Practical	Weightage	Contact hours
1. Physical and chemical analysis of water and effluents: Acidity, Alkalinity, Biochemical Oxygen Demand (BOD), Conductivity or Specific Conductance, Chemical Oxygen Demand (COD), Dissolved Oxygen, Fluoride, Hardness (Total), Oil and Grease, pH (PotentiaHydrogenii), Total Solids (TS), Total Suspended Solids (TSS), Total Dissolved Solids (TDS).	25%	10 hours
2. Air quality monitoring: Ambient and source emission monitoring	25%	5 hours
3. Measurement of emission	25%	5 hours
4. Analysis of parameters: pH, EC, Organic matter, Total nitrogen, Av. N, Av. P (Bray's and Olsen's), Total P. K, Na and SAR, Ca and Mg, Monitoring of Pb, Fe, Cu, Mn, Zn, Ni and Cr, Cd.	25%	10 hours

Instructional Method and Pedagogy: PPT, Video Presentation, Demonstration

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Remember terminologies of environmental pollution and its control CO2 Understand various sources and effects environmental pollutants CO3 Analyze various pollutants deteriorate the purity of environment CO4 Evaluate control and management of sources of environmental pollution CO5 Apply several standards and regulations to assess and manage quality of environment	Cognitive	Remember Understand Analyse Evaluate Apply

Learning Resources	
1.	Reference Books: 1. Nikhil Mukherjee (2008) Pollution Control and Environmental management; Cyber Tech Publications. 2. Environmental Pollution and Control by JF Peirce, RF Weiner, and PA Vesilind, Elsevier Science & Technology Book. 3. Metcalf and Eddy (2017) Waste water Engineering; McGraw Hill Education; 4th edition. 4. M Rao and H.V.N. Rao (2017) Air Pollution Hardcover; McGraw Hill Education; 1st edition.



	5. T. K. Ray (2004) Air pollution control in industries, Volume 1; Tech Books International. 6. R. Rajagopalan (2015) Environmental Studies; Oxford University Press, India. 7. Sudha Goel (2019) Water and Wastewater Engineering; Cambridge University Press; First edition. 8. Santosh Kumar Garg (1979) Environmental Engineering Sewage Waste Disposal And Air Pollution Engineering - Vol.2; Khanna Publishers; Thirty Seventh edition.
2.	Journals & Periodicals: 1. Environmental Pollutants and Bioavailability 2. Clean Air Journal 3. Emerging Contaminants
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	0	0	2	3



CO2	0	0	2	3
CO3	0	0	2	3
CO4	0	0	2	3
CO5	0	0	2	3
Avg.	0	0	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	1	1	2	2	1	1	0	0	2	2
CO2	3	1	0	0	2	2	2	3	0	1	3	3	3
CO3	1	2	2	2	1	2	2	1	2	1	1	2	1
CO4	2	2	0	3	2	3	2	3	1	1	1	3	2
CO5	3	2	0	1	3	2	2	2	1	1	1	2	3
Avg.	2	1	1	1	2	2	2	2	1	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS605A	COURSE NAME Professional Elective – I Smoke Control Systems	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Introduction to Fire Dynamics
Course Category	Professional Elective
Course focus	Employability
Rationale	The rationale behind smoke control systems is to protect occupants, facilitate evacuation, and aid firefighting operations in the event of a fire. Smoke control systems are designed to manage the movement of smoke within a building or structure, preventing its rapid spread and reducing the potential for smoke-related injuries, asphyxiation, and property damage. Here are some key rationales behind smoke control systems: Life Safety, Aid to Firefighters, Protection of Property, Compliance with Building Codes and Standards, Enhanced Egress System Design, Emergency Response Coordination, Advanced Fire Safety Strategies. Overall, the rationale behind smoke control systems is to protect lives, aid firefighting efforts, and reduce property damage during a fire. These systems are designed to control the movement of smoke, facilitate safe evacuation, and enhance the overall fire safety of a building or structure. By implementing effective smoke control measures, the risks associated with smoke inhalation and smoke-related hazards can be minimized, promoting the safety and well-being of building occupants and



	emergency responders.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1: To provide students with understanding of different constituents of smoke experienced in building fires, and its effects on occupants and materials 2.: To be able to quantify the toxicity and visibility effects of fires based on fuel and building parameters 3: To understand the different types of smoke control systems in buildings, and design concepts for the same 4: To be able to carry out calculations with respect to design of simple smoke control systems 5: To familiar with current code requirements for smoke control systems

Course Content (Theory)	Weightage	Contact hours
Unit 1: Combustion and smoke generation during fires. Different constituents of smoke such as particulates, unburned fuel, water vapor, carbon dioxide, carbon monoxide, and other toxic and corrosive gases. Process of smoke migration during building fires and impact on fire and life safety objective	20%	9 hours
Unit 2: Understand the concept of tenability in building fires. Calculations and models for prediction of visibility and toxic effects of smoke during fires. Limits prescribed by codes with respect to visibility, toxicity, temperature of smoke in performance-based calculations. Toxicity of Combustion Products, Dose, Dose/Response Relationships, Toxic Potency.	20%	9 hours
Unit 3: Different smoke control concepts and methods applied in buildings. Introduction to the concepts of compartmentation, dilution, pressurization and venting as applied for smoke control applications, and the type of buildings or building areas/features where they can be applied.	20%	9 hours
Unit 4: Smoke control systems applicable to corridors, atria, exit stairs, etc, and basic calculations related to system design and components. HVAC systems and their use in smoke control.	20%	9 hours
Unit 5: Evacuation Timing, Time Based Egress Analysis, understand prescriptive requirements and alternative approaches such as performance-based design (ASET-RSET analysis) for smoke control systems, as given in building codes such as NBC Part 4.	20%	9 hours

Instructional Method and Pedagogy: PPT, Video Presentation

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will		



be able to:

CO1 Understand the constituents of smoke building fires, and its effects on occupants and materials	Cognitive	Understand Analyse Evaluate
CO2 Analyze toxicity and visibility effects of fires		
CO3 Evaluate the types of smoke control systems		

Learning Resources

1.	Reference Books: 1. Kolte, Milked, Principles of Smoke Management, ASHRAE/SFPE 2. DiNenno, P.J. (Ed.), SFPE Handbbok of Fire Protection Engineering (4th Edition), NFPA, Quincy, MA, 2008, 3. Quintiere, J. G., Fundamentals of Fire Phenomena, John Wiley & Sons, Chichester, UK, 2006. 4. Drysdale D, An Introduction to Fire Dynamics, 3rd Edition, John Wiley & Sons
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1
CO2	1	2	2	1
CO3	1	2	1	1
Avg.	1	2	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3	3
CO2	1	2	2	2	1	2	2	1	2	1	1	2	1
CO3	2	2	0	3	2	3	2	3	1	1	1	3	2
Avg.	2	2	1	2	2	2	2	2	1	1	2	3	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS605B	COURSE NAME Professional Elective – I Behaviour Based Safety	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Safety Management I & II
Course Category	Professional Elective
Course focus	Employability
Rationale	The rationale behind behavior-based safety (BBS) is to promote a proactive and preventive approach to workplace safety by focusing on individual behavior and its impact on overall safety performance. BBS aims to create a safety culture where employees take personal responsibility for their actions and actively participate in identifying and mitigating safety risks. Here are some key rationales behind behavior-based safety: Injury Prevention, Employee Engagement and Empowerment, Continuous Improvement, Proactive Approach, Cultural Transformation, Integration with Other Safety Programs, Positive Reinforcement and Recognition. Overall, the rationale behind behavior-based safety is to promote a proactive and preventive approach to workplace safety by focusing on individual behaviors. By addressing unsafe behaviors, engaging employees, and creating a positive safety culture, BBS aims to prevent incidents, reduce injuries, and continuously improve safety performance. It recognizes that individual actions and choices play a significant role in creating a safe and healthy work environment.
Course Revision/ Approval Date:	5th March 2024
Course Objectives:	To enable the student to: 1: To understand the principles of behaviour based safety 2: To understand the various human behaviours and identify the critical behaviours 3: To illustrate steps of behaviour based safety in organization 4: To understand the human factors and methods of human error



Course Content (Theory)	Weightage	Contact hours
Unit 1: Principles of Behaviour Based Safety Origin & history of BBS – definitions – psychology, human behaviour, attitude, aptitude, personality, memory - components of an ideal safety culture – psychology of behaviour-based management – factors affecting human behaviour in complexity – link between unsafe actions & BBS.	20%	9 hours
Unit 2: Human Behaviour Characters Behaviour – human factors contributing to accident – human capability and risk assessment - psychological aspects of safety – safety culture system – individual decision making process – identification of critical behaviours - behaviour function of self and situation – scientific method to improve behaviour - perception of risk and acceptance of risks	20%	9 hours
Unit 3: Behaviour Based Safety in Organization Features of organization – organizational structures – work groups, group dynamics and behaviour, vulnerable groups, leadership – Training to improve BBS – BBS implementation and steering committee – problems in implementing BBS – action plan - BBS programme for employees – performance measure - benefits of BBS.	20%	9 hours
Unit 4: Human Factors & Errors Human factors and industrial safety, process control & system design – employee selection process - Introduction to human errors – classification - Types of human errors – Methods of human error assessment, HEART, SPAR-H, SLIM, Task Analysis and other methods – Prevention & mitigation of human error	20%	9 hours
Unit 5: Ergonomics Ergonomics – scope – principles – human engineering – man machine interface – task analysis and design – work conditions, ergonomics & health - Ergonomic consideration in manual material handling – Ergonomic workstations.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Remember principles of behaviour based safety CO2 Understand psychology of behaviour based safety and focus on behaviour to manage the risk		Remember Understand



CO3	Understand organizational behaviour, perception of danger and acceptance of risk	Cognitive	Understand
CO4	Evaluate human factors and methods of assessing human error		Evaluate Evaluate
CO5	Evaluate ergonomics, its associated hazards and workstations		

Learning Resources

1.	Reference Books: 1. Safety and Human Error in Engineering Systems, B.S.Dhillon, CRC Press 2. Handbook of applied behavior Analysis”, wayne W. Fisher, Calhleen C. Piazza, HentryS.Roane – 2015. 3. Human factors and behavioral safety, J.Stranks, Elsevier publications, 2007 4. Human factor methods for improving performance in the process industries”, Center for chemical process Safety – 2006. 5. Guidelines for human preventing human error in process safety”, Center for chemical process Safety – 2004
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	0	1	2
CO2	2	0	1	1
CO3	2	1	1	1



CO4	2	0	2	0
CO5	2	0	2	0
Avg.	2	0	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	1	1	2	2	1	1	0	0	2	2
CO2	3	1	0	0	2	2	2	3	0	1	3	3	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3	3
CO4	2	2	0	3	2	3	2	3	1	1	1	3	2
CO5	2	2	0	3	2	3	2	3	1	1	1	3	2
Avg.	2	1	0	1	2	2	2	3	1	1	2	3	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS605C	COURSE NAME Professional Elective – I Climate Change and Sustainability	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Environmental Pollution & Control Measures
Course Category	Professional Elective
Course focus	Employability
Rationale	The rationale behind addressing climate change and promoting sustainability lies in the urgent need to mitigate the impacts of climate change, protect the environment, and ensure a sustainable future for current and future generations. Climate change refers to long-term shifts in weather patterns and global temperatures, largely caused by human activities, particularly the burning of fossil fuels and deforestation. Here are some key rationales behind addressing climate change and promoting sustainability: Mitigation of Environmental Impacts, Protection of Human Health and Well-being, Preservation of Natural Resources, Economic Opportunities and Job Creation, Social Equity and Justice, Global Cooperation and Responsibility, Future Generations. Overall, the rationale behind addressing climate change and promoting sustainability is rooted in the urgent need to mitigate the impacts of climate change, protect the environment, promote human well-being, and ensure a sustainable future for all. It requires a collective and comprehensive approach, involving individuals, communities, businesses, governments, and international cooperation. By taking action



	now, we can contribute to a more sustainable and resilient world for ourselves and future generations.
Course Revision/ Approval Date:	5th March 2024
Course Objectives:	To enable the student to: 1: To introduce the basic concepts of climate change science 2: To critically analyze climate change, greenhouse effect and their effects on global environment 3: To distinct between principal sources of renewable and non-renewable energy 4: To represent different forms of energy and the relevance of sustainability in energy systems 5: To propose the remedies for environmental sustainability

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to Climate Change: Overview of key concepts such as earth surface temperature, climate, weather and the greenhouse gas effect, complex global climate system. Observed and projected trends and impacts of climate change. Introduction to Earth's energy balance & climate, natural and anthropogenic GHGs: CO ₂ , CH ₄ , N ₂ O, HFCs, CFCs, SF ₆ , NF ₃ . Definitions of 1.5°C and 2°C, Warming relative to pre-industrial levels, Global versus regional and seasonal warming. Relation between Climate change and global warming, Evidence of global warming, causes of climate change - anthropogenic and natural factors.	20%	9 hours
Unit 2:The Science of Climate Change: Contribution of greenhouse gases to the natural greenhouse effect, other human influence in the form of urbanization and industrialization, link between air pollution and global climate change. Possible causes of climate change: temperature, precipitation, ocean pH, global warming, the Ozone layer, aerosols, Natural climate fluctuations viz. surface temperature, El Nino and La Nina, sea level rise, glacier melting. Challenges for urban areas in 21st century, how urban areas are affected by, and contribute to, climate change. Managing the impacts of climate change: mitigation, adaptation strategies, environmental planning and sustainable development for climate resilience.	20%	9 hours
Unit 3: Sources of energy: Fossil fuels – classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas. Introduction to other sources of energy: Nuclear energy, Bio-energy, Energy from Wastes. Principles of generation of hydro-power, tidal energy, ocean thermal energy conversion, wind power, geothermal energy, solar energy. Environmental implications of energy use; energy use pattern in India. Impacts of large-scale exploitation of solar, wind, hydro and nuclear energy sources.	20%	9 hours
Unit 4: Principles of sustainability: History and definition of sustainability, objectives, the three pillars of sustainability – economic, social and environmental. Precautionary principle, polluter pays as	20%	9 hours



examples of drivers for sustainability, Carbon Footprints. Recent and Future developments with regard to the Clean Development Mechanism (CDM), long term perspective on mitigation activities. Sustainability indicators, hurdles to achieve sustainability, operational guidelines, performance indicators of sustainability.		
Unit 5: Environmental sustainability: Introduction to role and responsibilities of IPCC, UNFCCC, WMO, MOEFCC, GFCS. A brief on important reports like Assessment Report (AR 1-6) and methodology reports published by IPCC, the Kyoto protocol, outcomes of COP 1-26. Overview of the UN Global Compact in respect of the environment (Principles 7-9), The purpose of the UN Sustainable Development Goals and targets. Rio principles, international summits, Tokyo declaration, policies for socio-economic development. Remedies for a sustainable energy system, Financial Assistance from Governments, Future Energy Scenario of the World.	20%	9 hours

Instructional Method and Pedagogy: (Max. 100 words)
PPT

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Remember basic concepts of climate change science CO2 Understand climate change, greenhouse effect and their effects on global environment CO3 Understand principal sources of renewable and non-renewable energy CO4 Understand different forms of energy and the relevance of sustainability in energy systems CO5 Evaluate remedies for environmental sustainability	Cognitive	Remember Understand Understand Understand Evaluate

Learning Resources	
1.	Reference Books: 1. Asheem Srivastav (2019) The Science and Impact of Climate Change, Springer Nature Singapore. 2. M. R. Islam, M. M. Khan (2019) The Science of Climate Change, Scrivener Publishing LLC. 3. Manoj K. K. (2021) Environmental Planning and Sustainable Development, Orange Books Publication; First edition.



	4. A. Gope, A. Sarkar, P. Sarkar, S. Majumder, K. Gosai (2019) Environmental Issues & Sustainable Development, Notion Press. 5. Samir Saran and Aled Jones (2017) India's Climate Change Identity Between Reality and Perception, Palgrave Macmillan. 6. Assessment Reports 1 – 6, IPCC: https://www.ipcc.ch/about/ 7. IPCC Methodology Report, IPCC: https://www.ipcc.ch/reports/?wg=tfi 8. S.C. Santra (2005) “Environmental Science”, 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India. 9. P. G. Özuyar, T. Wall, L. Brandli, A. M. Azul, W. L. Filho (2019) Sustainable Cities and Communities; Springer, Cham. 10. R. Schmidpeter, Samuel O. Idowu, Liangrong Zu (2019) The Future of the UN Sustainable Development Goals: Business Perspectives for Global Development in 2030, Springer, Cham
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	0	0	0	3
CO2	0	0	0	3
CO3	0	0	0	3
CO4	0	0	0	3
CO5	0	0	0	3
Avg.	0	0	0	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	1	1	2	2	1	1	0	0	2	2
CO2	3	1	0	0	2	2	2	3	0	1	3	3	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3	2
Avg.	3	1	0	1	2	2	2	3	0	1	2	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTOE07	COURSE NAME Open Elective Industrial Safety	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	-
Course Category	Open Elective
Course focus	Employability
Rationale	The rationale behind studying industrial safety as a subject lies in the need to prevent workplace accidents, injuries, and occupational hazards in industrial settings. Industrial safety focuses on identifying and mitigating potential risks and hazards in order to create a safe and healthy work environment for employees. Here are some key rationales for studying industrial safety: Employee Safety and Well-being, Accident Prevention, Legal Compliance, Productivity and Efficiency, Organizational Reputation and Employee Morale, Risk Management, Continuous Improvement. Overall, the rationale behind studying industrial safety as a subject is to create a safe and healthy work environment, prevent workplace accidents, comply with legal requirements, enhance productivity and efficiency, protect organizational reputation, and foster a culture of safety. By gaining knowledge and skills in industrial safety, individuals contribute to the well-being of employees, the success of organizations, and the overall advancement of industrial operations.
Course Revision/ Approval Date:	03/03/2023
Course Objectives	To enable the student to: 1: To learn the history of safety movement and various organizations 2: To explain the classifications of hazards and various work



environment

3: To illustrate risk matrix and risk computation for various activities at workplace

4: To familiarize with accident investigation and reporting

5: To learn performance measurement and audits

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction: History of safety movement - ILO – NSC – BSC – LPA and Industrial safety. ILO conventions and recommendations. Occupational safety and health country profile of India. Introduction to hazard, risk, incident, accident, near-miss, occupational health, occupational diseases, industrial hygiene, welfare, total loss control/prevention, etc.	20%	9 hours
Unit 2: Classification of workplace hazards, identification of common hazards at workplace: electricity, stress, temperature, illumination, fire, slip, trip and fall, hazardous substances, noise, vibration. Introduction to other activities involving risk at workplace: Machinery safety, Workplace transport, Lifting and manual handling, Pressurized cylinders and equipment, Special group of workers, Plant and equipment maintenance.	20%	9 hours
Unit 3: Assessment of Risk: Likelihood, consequence, formula of risk, basics of risk assessment, 5 step risk assessment method, 3x3 and 5x5 risk matrix, working examples for calculation of risk. Principles of control: Introduction, principles of prevention, Hierarchy of control, safe system of work, Loss prevention, Preventive controls, Corrective controls, Directive controls, Detective controls.	20%	9 hours
Unit 4: Incident and accident reporting: definitions, difference, reasons for investigation, costs involve – iceberg theory, reporting process and working examples of reporting process and forms. Accident investigation: which accident should be investigated, investigation procedure, common causes of accident in workplace, information collecting and methods of data analysis, legal requirements for accident investigations.	20%	9 hours
Unit 5: Performance measurement: benefits of performance measurement, Measurement techniques: Proactive and reactive monitoring, performance measurement of range of people/employees. Inspections and auditing: ways to obtain information - documents, interviews and observations. Types of audits – internal and external. Feedback discussion and implementation strategy.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Tutorial, Case Studies, Animated Videos

Course Outcomes:

	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
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After successful completion of the above course, students will be able to:

CO1: **Remember** the concept of safety in workplace

CO2: **Understand** hazards, consequence and risk in various workplace

CO3: **Apply** qualitative risk assessment to categorize the risk level

CO4: **Understand** accident investigation and reporting

CO5: **Evaluate** safety performance through audits and inspections

Cognitive

Remember
Understand
Apply

Understand
Evaluate

Learning Resources

1.	Reference Books: 1. HSE (2006) Essentials of health and safety at work, Health and Safety Executive. 2. L. M. Deshmukh (2005) Industrial Safety Management, Tata McGraw-Hill Publishing Company. 3. K. U. Mistry, Fundamentals of Industrial Safety, Siddharth Prakashan. 4. Phil Hughes and Ed Ferrett (2011) Introduction to Health and Safety at Work, Routledge, 6th Edition. 5. C. Ray Asfahl and David W. Rieske (2010) Industrial Safety and Health Management, Pearson Publication. 6. Benjamin O. ALLI (2008) Fundamental Principles of Occupational Health and Safety, International Labour Organization.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	40 Marks

**Mapping of PSOs& COs**

	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	2	2	1	1
CO3	1	1	0	2
CO4	1	2	0	0
CO5	0	2	0	1
Avg.	1	2	0	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2	3
CO2	1	3	2	3	2	2	1	1	2	1	2	2	1
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	3	1	0	1	3	2	2	2	2	1	1	2	3
CO5	3	1	0	1	3	2	2	2	2	1	1	2	3
Avg.	3	1	0	1	3	2	2	2	2	1	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTOE08	COURSE NAME Open Elective Fire Science	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	-
Course Category	Open Elective
Course focus	Employability
Rationale	The rationale behind studying fire safety as a subject lies in the critical



	importance of preventing, controlling, and mitigating the risks associated with fires. Fire safety encompasses the knowledge, skills, and strategies needed to prevent fires, protect people and property from fire incidents, and respond effectively in the event of a fire. Here are some key rationales for studying fire safety: Life Safety, Property Protection, Legal Compliance, Risk Assessment and Management, Fire Investigation and Analysis, Emergency Response and Preparedness, Public Awareness and Education. Overall, the rationale behind studying fire safety as a subject is to prevent fire incidents, protect lives and property, ensure legal compliance, assess and manage fire risks, investigate fire incidents, prepare for emergencies, and promote public awareness. By gaining knowledge and skills in fire safety, individuals contribute to the safety and well-being of individuals and communities, and play a vital role in preventing and mitigating the devastating effects of fires.
Course Revision/ Approval Date:	5th March 2024
Course Objectives	To enable the student to: 1: To appraise the concept of combustion and Thermochemistry. 2: To apply the principles of stoichiometry and chemical kinetics. 3: To identify and describe the products of combustion and their flammability. 4: To apply the factors which influence compartment fire and the behaviour of fire plumes in solving engineering problems. 5: To explain the main mechanisms of fire extinction and describe the principles of fire detecting devices.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction: The role of fire science in fire engineering in the built and natural environment; role of fire science in engineering design. Science involved in Fire. History of Fire and case study of past large fire and fire disasters. Introduction to Thermodynamics, Fluid mechanics, Heat and mass transfer.	15%	6 hours
Unit 2: Anatomy of Fire: Fire triangle, Tetrahedron of Fire, role of oxygen, fuel and temperature in combustion, classification of fires, method to extinguish the fire. Introduction to Chemical chain reaction. Stages of fire/compartment fires. Chemistry of combustion, complete and incomplete combustion, Oxidizers, Heat of reaction & calorific values, Mole concept, Stoichiometry, fuel/air mixture ratio, Ignition point & flash point of flammable liquids, saturated and unsaturated hydrocarbons. LFL & UFL, Flammability Range, Categories of Liquid Fires, Flash Point and Fire Point.	25%	10 hours
Unit 3: Fire and Explosions: Introduction to smoldering, spontaneous Combustion, Flaming and Non-flaming combustion. Different forms of Natural Fire: Diffusion Flames, Smoldering, Spontaneous Combustion, Premixed Flames. Anatomy of an Explosion, Explosives and Blasting Agents. Introduction to: Boiling-Liquid Expanding-Vapor Explosions,	20%	10 hours



Unconfined Vapour Cloud Explosions, Confined Vapour Cloud Explosions, Cylinder Failures, Dust Explosions.		
Unit 4: Compartment Fire and smoke movement: Phases of fires in enclosures, Heat Transfer, Fire/flame Spread, Factors affecting fire spread in enclosures, types of ventilation and their effects on fire spread. Introduction to fire plums and movement of smoke in enclosures. Calculation of Fire load, calorific value of various fuels, working examples of calculation of fire load for various occupancies.	20%	9 hours
Unit 5: Introduction to Active fire protection systems: Fire extinguishing agents, hydrant pipes – hoses – monitors, foam generators, Water Sprinkler, MVWS and HVWS, Clean agent system, alarm and detection systems. Introduction to Passive fire protection systems: General exit requirements, Egress components, compartmentation, fire door, windows, fire resistance, signs and evacuation plans.	20%	10 hours

Instructional Method and Pedagogy:

PPT, Video Presentation

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Remember principles and basics of fire chemistry CO2: Understand stoichiometry and chemical kinetics for the process of combustion CO3: Evaluate the products of combustion and their flammability CO4: Evaluate factors which influence compartment fire and the behaviour of fire plumes in solving engineering problems CO5: Understand principles and operating mechanisms of fire prevention and protection devices	Cognitive	Remember Understand Evaluate Evaluate Understand

Learning Resources

1.	Reference Books: 1. Purandare A. (2006) Handbook on Industrial Fire Safety, P&A Publication 2. Freidman R. (1998) Principle of Fire Protection Chemistry and Physics, NFPA 3. Quintiere, J.G. (2006) Fundamentals of Fire Phenomena John Wiley and Sons Ltd 4. Quintiere, J.G. (1998) Principles of Fire Behaviour, Delmar Publishers. 5. BIS (2016) National Building Code Part IV, Bureau of Indian Standards
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	6. ASTM (1985) Fire Safety: Science and Engineering, American Society for Testing and Materials 7. NFPA (200) Fire Protection Handbook, National Fire Protection Association. 8. SFPE (2003) Handbook of Fire Protection Engineering, The SFPE Handbook of Fire Protection Engineering
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	2	2	1	1
CO3	1	1	0	2
CO4	1	2	0	0
CO5	0	2	0	1
Avg.	1	2	0	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2	3
CO2	1	3	2	3	2	2	1	1	2	1	2	2	1
CO3	3	1	0	1	3	2	2	2	2	1	1	2	3
CO4	3	1	0	1	3	2	2	2	2	1	1	2	3
CO5	3	1	0	1	3	2	2	2	2	1	1	2	3
Avg.	3	1	0	1	3	2	2	2	2	1	1	2	3



COURSE CODE AECC601	COURSE NAME Indian Constitution	SEMESTER VI
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
2	0	0	2	2	0	0	2

Course Pre-requisites	-
Course Category	Ability Enhancement Compulsory Courses
Course focus	Employability/ Entrepreneurship/ Skill development
Rationale	The rationale behind studying the Indian Constitution as a subject lies in its significance as the fundamental law of the country. The Indian Constitution serves as a comprehensive framework that defines the principles, structure, and functioning of the Indian government and guarantees fundamental rights and freedoms to its citizens. The few key rationales for studying the Indian Constitution are Understanding the Governance Structure, Judicial Interpretation, Preserving Constitutional Values, Enhancing Civic Engagement and Participation, Constitutional Amendments, Promoting Social Justice and Equality, Ensuring Constitutional Governance, Protection of Fundamental Rights. Overall, studying the Indian Constitution as a subject is essential for understanding the principles of governance, safeguarding fundamental rights, promoting social justice, and actively participating in the democratic process. It equips individuals with knowledge and awareness of their rights, responsibilities, and the functioning of the Indian government, fostering a society that upholds the values enshrined in the Constitution.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To understand Indian Constitution To know the framework of Indian Constitution To aware role of government of the union



To aware role of the state government
To understand administration organization

Course Content (Theory)	Weightage	Contact hours
Unit 1: Constitution – Strategies and Principles: Meaning and important of constitution - Making of Indian constitution – sources - Salient Features of Indian constitution.	20%	6 hours
Unit 2: Fundamental Rights and Directive Principles: Fundamental Rights - Fundamental Duties - Directive Principles	20%	6 hours
Unit 3: Government of the Union: President of India – Election and powers, Prime Minister and council of ministers, Lok Sabha – composition and Powers, Rajya Sabha – Composition and Powers	20%	6 hours
UNIT 4: Government of the States & The Judiciary: Governor – Powers, Chief Minister and Council of ministers, Legislative Assembly – Composition and Powers, Legislative Council – Composition and Powers, Features of judiciary system in India, Supreme Court – Structure and Jurisdiction	20%	6 hours
Unit 5: Constitution: Federalism in India – features, Local Government – Panchayats and Powers and functions 73rd and 74th Amendments, Election Commission – Organization and functions, Citizen Oriented Measure – RTI and PIL – Provisions and Significance.	20%	6 hours

Instructional Method and Pedagogy:
PPT

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1 Understand importance of Indian constitution CO2 Understand powers of state and union government CO3 Understand administration of Indian Constitution	Cognitive	Understand Understand Understand

Learning Resources	
1.	Reference Books: 1. Introduction to the constitution of India, Durga Das Basu LexisNexis 2. Indian's Constitution by M.V. Pylee , New Delhi S. Chand Publication 3. The Constitutional Law of India by J.N. Panday Allahabad Central Law Agency
2.	Journals & Periodicals:



Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Open Book Assignment</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Open Book Assignment	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Open Book Assignment	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	0	0	0	0
CO2	0	0	0	0
CO3	0	0	0	0
Avg.	0	0	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	1	1	2	2	1	1	0	0	2	2
CO2	3	1	0	0	2	2	2	3	0	1	3	3	3
CO3	1	2	2	2	1	2	2	1	2	1	1	2	1
Avg.	2	1	1	1	1	2	2	2	1	1	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



Teaching Scheme

Semester –VII

Sr. No	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTFS701	Structural Behaviour & Passive Fire Protection	3	0	0	3	3	0	0	3	20	40	40	100	-	100
2.	BTFS702	Managing Occupational Health	3	2	0	4	3	1	0	4	20	40	40	100	50	150
3.	BTFS703	Safety Inspections & Audits	1	2	1	3	1	1	1	3	20	40	40	100	50	150
4.	BTFS704	Environmental Impact Assessment	3	0	0	3	3	0	0	3	20	40	40	100	-	100
5.	BTFS705	Fire & Safety in Major Accident Hazard Units	4	0	0	4	4	0	0	4	20	40	40	100	-	100
6.	BTFS706	Professional Elective -II	3	0	0	3	3	0	0	3	20	40	40	100	-	100
8.	BTFS707	Industrial Internship	0	0	0	2	0	0	0	2	-	-	100	-	-	100
9.	BTFS708	Minor Project	0	4	0	2	0	2	0	2	-	-	100	-	100	100
Total			17	1	1	24	17	4	1	24						

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester



COURSE CODE BTFS701	COURSE NAME Structural Behaviour & Passive Fire Protection	SEMESTER VII
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Building fire prevention & protection
Course Category	Professional Core
Course focus	Employability
Rationale	The rationale behind understanding structural behavior and implementing passive fire protection measures is to ensure the safety and integrity of buildings and structures. Both aspects play crucial roles in protecting occupants and property from the effects of fire. 1. Structural Behavior: Structural behavior refers to the response of a building or structure to various loads and forces, including gravity, wind, seismic activity, and other environmental factors. Understanding structural behavior is essential for designing and constructing buildings that can withstand these loads and maintain their stability. The key rationales are Safety, Load distribution, Performance under Extreme Events, Optimal Design. 2. Passive Fire Protection: Passive fire protection refers to measures that are designed to prevent or slow down the spread of fire within a building. It includes the use of fire-resistant materials, compartmentalization, fire barriers, and other strategies that do not rely on active systems like fire sprinklers or extinguishers. The key elements are Life Safety, Property Protection, Firefighter Safety, Code Compliance, Insurance Requirements.
Course Revision/ Approval Date:	5 th March 2024

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to main elements of structure - load bearing and non-load bearing, their function and design principles. Behaviour of structural elements at elevated temperature, and effect on overall structure. Importance and contribution of structural fire resistance to overall fire safety and code requirements related to fire resistance of building structure (NBC part 4).	20%	9 hours
Unit 2: Active versus passive fire protection. Understand concept of fire resistance, different time-temperature curves and criteria used for fire resistance testing. Concept of fire severity & factors affecting fire severity. Different methods applied for calculating fire severity (Lie, Eurocode, etc) and carry out simple	20%	9 hours



calculations. Column/ beam behavior at elevated temperature and calculation methods for assessing performance.		
Unit 3: Behaviour of different construction materials under fire. Concrete spalling and related factors - methods for improvement. Loss of strength in steel with temperature and methods for protection of steel members. Masonry behavior in fire and improvement. Behaviour of different woods under influence of fire; process of charring Different methods used for improving fire resistance of steel and wood. Behaviour of other building materials; glass, polymers, cladding materials. Test methods applied for assessing fire performance of materials.	20%	9 hours
Unit 4: Compartmentation and its importance in building fire and life safety Code requirements for compartmentation based on occupancy i.e., separation of occupancies, maximum compartment sizes depending on occupancies, fire protection of exits, compartmentation of hazardous areas. Code guidelines for concrete/masonry wall dimensions for specific fire resistance. Requirements for doors/windows and other openings in compartments, and test methods for assessment of performance.	20%	9 hours
Unit 5: The need for having openings in walls and compartments for various building services and systems, curtain wall cladding gaps and issues related to fire and life safety. Different Fire stop materials and systems used for curtain wall cladding through wall penetrations, etc. Fire and Fire/Smoke dampers used in HVAC system and their characteristics.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies, Site Visits

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1: Understand effects of fire on building materials, building elements and structure CO2: Evaluate fire severity, and behaviour of columns/beams at elevated temperature CO3: Understand fire and life safety issues associated with curtain wall cladding, through penetrations and become familiar with different fire-stopping materials and practices CO4: Understand compartmentation in structural fire safety CO5: Evaluate current legal code requirements related to structural fire safety	Cognitive	Remember Understand Evaluate Evaluate Understand

Learning Resources

1.	Reference Books:
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	1. Buchanan A.H, Structural Design for Fire Safety 2. Fire Service Manual, Volume 3 Fire Safety, Basic Principles of Building Construction, HMSO Books 3. NFPA Fire protection Handbook, Section 18 &1 9, Vol. 2, 20th Edition. 4. National Building code of India 2016, Part-4, BIS
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory:Mid semester Marks	20 marks										
Theory:End Semester Marks	40 marks										
Theory:Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Article Review	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None





COURSE CODE	COURSE NAME	SEMESTER
BTFS702	Managing Occupational Health	VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	4	3	1	0	4

Course Pre-requisites	Industrial Hygiene & Toxicology
Course Category	Professional Core
Course focus	Employability
Rationale	Worker Health and Well-being, Compliance with Legal Requirements, Enhanced Productivity and Performance, Reduction of Work-related Injuries and Illnesses, Cost Savings, Compliance with Social Responsibility, Sustainable Workforce. In summary, managing occupational health is crucial for protecting workers' health and well-being, complying with legal requirements, enhancing productivity, reducing workplace injuries and illnesses, achieving cost savings, fulfilling social responsibility, and maintaining a sustainable workforce. It is an integral part of responsible business practices and contributes to creating safe, healthy, and thriving workplaces.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	1: To introduce the nature of occupational health and associated hazards 2: To summarize the principles and methods of controlling noise and noise exposure. 3: To discuss the principles and methods of controlling vibration and vibration exposure. 4: To summarize heat and radiation hazard and their control measures. 5: To identify the types and properties of biological agents found at work.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Definitions of the general terms: Health, Safety, Welfare, Occupational health, accidents, dangerous occurrences, near-miss, work related ill-health etc. Direct and indirect costs of accidents and ill-health insured and uninsured costs, health and safety culture. Role of national government and international organization's in formulating a framework for regulation of OHS, Introduction to Chapter – III of The Indian Factories Act, 1948 and The	20%	9 hours



Gujarat Factories Rules, 1963.

Unit 2:

The human ear, Ill-health effects of noise, the types of instrumentation for measurement of noise, the importance of calibration, the concept of equivalent noise dose (LAeq, LEP, d, weekly and peak). Types of hearing loss. Noise control techniques, Personal ear protection.

The meaning of 'Vibration', Sources of Vibrations, examples of machinery and their typical emission levels, comfort levels, concept of equivalent vibration dose. Whole body vibration (WBV), hand-arm vibration (HAV), instrumentation for carrying out vibration assessments, the use of vibration calculators to determine mixed exposures. Comparison with legal limits and control techniques.

20%

9 hours

Unit 3:

Sources of Heat hazards, modes of heat transfer, Effects of Extremes of temperature on human body, Work in hot environments, Heat stress and heat strain, Fluid intake and thirst, Assessment of the thermal environment. Radiation hazards: Sources of ionising radiation at workplace, Concept of Half-life, energy, exposure, absorbed dose. Harmful effects of ionising radiation, Radiation measurement and types of instruments, Radiation protection strategies.

20%

9 hours

Unit 4:

Understanding Human Factors and Ergonomics: Brief History of Ergonomics Fit the Man to the Job versus Fitting the Job to the Man, Manual work, load lifting techniques, Postural Stability. Causes of - Low Back Pain, Back Pain, WMSD, Disorders of the Neck, CTS, Disorders of the Shoulder. Assessment of Worker Functional Capacities, Revised NIOSH Lifting Equation. Controls: Reaction Time When a Target Is Detected, control techniques - Administrative and work practice controls, engineering controls, PPE.

20%

9 hours

Unit 5:

Biological hazards in the workplace, Types of micro-organisms, Risk-based classification of micro-organisms, Specific work environments and diseases/illnesses. Human diseases and allergies, Allergic Sensitizers, Histoplasmosis, Bagassosis, Woodworker's lung, Byssinosis, Occupational Cancer. Control of biological hazards in the workplace, Containment of micro-organisms, Aerosol suppression, Biological monitoring of workers.

20%

9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Remember nature and principles of occupational health CO2: Understand methods of controlling noise and noise exposure CO3: Understand methods of controlling vibration and	Cognitive	Remember Understand Evaluate



vibration exposure

CO4: Evaluate heat and radiation hazard and their control measures

CO5: Evaluate types and properties of biological agents found at work

Evaluate

Understand

Learning Resources

1.	Reference Books: 1. R. K. Mishra (2015) Occupational Health Management 1 Edition, AITBS Publishers. 2. S. C. Sharma and V. Kumar (n.d.) Safety, Occupational Health and Environmental Management in Construction, Khanna Publications. 3. R. K. Jain (2000) Industrial Safety, Health and Environment Management Systems, Khanna Publishers. 4. Jeremy Stranks (2006) the health & safety handbook a practical guide to health and safety law, management policies and procedures, kogan page limited. 5. Charles D. Reese (2016) Occupational Health and Safety Management-A Practical Approach, CRC Press.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

List of Practical	Weightage	Contact hours
1: Measurement of human blood pressure using blood pressure monitor	15%	3
2: Measurement of blood sugar level using blood glucose monitoring	10%	3
3: Determining the hearing threshold using digital audiometer	10%	3
4: Estimate the oxygen saturation of the blood and pulse rate using pulse oximeter	10%	3
5: Study of eyesight and test for colour blindness	10%	4
6: Measurement of body temperature using thermometer	10%	3
7: Determining the vibrations of machines using vibrometer	10%	3
8: Study of lung function test using spirometer	10%	4
9: Evaluation of heart beats using electrocardiogram	15%	4

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks



Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks
Practical Marks	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	50 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS703	COURSE NAME Safety Inspections and Audits	SEMESTER VII
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
1	2	1	3	1	1	1	3

Course Pre-requisites	Hazard Identification, Risk Management & Control Techniques
Course Category	Professional Core
Course focus	Employability
Rationale	Safety inspections and audits involve systematic assessments of workplaces, processes, procedures, and safety management systems. Here are the key rationales for conducting safety inspections and audits: Hazard Identification and Risk Assessment, Compliance with Legal and Regulatory Requirements, Continuous Improvement, Prevention of Accidents and Incidents, Employee Engagement and Participation, Management Accountability, Reputation and Stakeholder Confidence. In summary, safety inspections and audits are conducted to identify hazards, assess risks, ensure compliance, drive continuous improvement, prevent accidents, engage employees, hold management accountable, and enhance organizational reputation. These processes contribute to the creation of a safe and healthy work environment, protect employees' well-being, and promote the long-term success and sustainability of the organization.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	1: To describe the aim and objectives of safety inspections and audit 2: To evaluate a systematic, critical appraisal of all potential hazards involving personnel, plant, services, and operation method 3: To appraise various milestones involving fire audit at different occupancies 4: To critically analyze that OS&H system of a facility fully satisfies the legal requirements

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to Safety Audit, Scope, Audit Program Purpose and Objectives and Guidance of audit, Audit Protocol, Audit Team Selection, Allocation of Resources, Legal Considerations, Audit Frequency. Pre Audit - Schedule the Audit, Communications, Regulation and Company Policy Review.	20%	4 hours
Unit 2: OS&H audit as per IS 14489 - Audit Goals, Roles and Responsibilities of Auditors, client, auditee. auditing methodology, Steps to execute the OS&H Audit. Workplace Safety Audit: Injury Rates, Housekeeping, Item-Specific inquiry, Employee Perception Survey, medical/health reports, Employee Interviews, Incident Investigation reports and analysis, Safety Committee Activity,	20%	4 hours



Documentation Review, Training reports.

Unit 3:

Fire Audit: Type of Industry, means of egress, Design and construction of exit routes, Maintenance, safeguards, and accessibility of exit routes, Emergency action plans, Portable fire extinguishers, Fixed extinguishing systems, Fire detection systems, PA system, hazardous activities and surroundings, Ventilation, Training reports, accessibility of Fire-Fighting Vehicles, Care and Maintenance report of Self-Contained Breathing Apparatus.

20%

4 hours

Unit 4:

Audit report: Closing Conference, Preparation of Risk Assessment Report and its compliance Preparation of Safety Report, use of identified risks and scenarios from Safety Audit. Report Content, Report Distribution, Record Retention, OS&H audit completion, Follow-Up.

20%

3 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Understand basic principles of OS&H audit. CO2: Evaluate potential hazards involving personnel, plant, services, and operation method. CO3: Understand specific issues of conducting audits in the area of fire safety. CO4: Apply audit and prepare an assessment report.	Cognitive	Understand Evaluate Understand Apply

Learning Resources

1.	Reference Books: 1. E. Scott Dunlap (2011) Loss control auditing, CRC Press. 2. Simon Watson Pain (2018) Safety, Health and Environmental Auditing: A Practical Guide, Second Edition, CRC Press. 3. CCPS (1992) Guidelines for Auditing Process Safety Management Systems, CCPS. 4. IFSTA (n.d.) Fire Inspection and Code Enforcement, 8th Edition, IFSTA.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

List of Practical	Weightage	Contact hours
1: Preparation of questionnaire or checklist based on various guidelines	20%	2
2: Preparation of Safety audit as per IS:14489 - Audit Plan, Working Documents of the Audit Team, Questionnaire or checklist for collection of preliminary information, visit and examination of various facilities i.e industries & various occupancies.	40%	6
3: Fire Audit as per NBC Part IV: Audit plan, document preparation for the fire audit, Questionnaire or checklist for collection of Preliminary	40%	7



Information, list of minimum fire prevention and protection requirements, visit and examination of various occupancies.

List of Tutorial	Weightage	Contact hours
1: Preparation of questionnaire for audit	10%	2
2: Preparation of checklist for audit	10%	3
3: Preparation of safety audit plan	10%	2
4: Method of collection of preliminary information	10%	2
5: Examination of various facilities	10%	3
6: Preparation of fire audit plan	10%	3

Evaluation Scheme	Total Marks												
Theory: Mid semester Marks	20 marks												
Theory: End Semester Marks	40 marks												
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks		
Attendance	05 marks												
MCQs	10 marks												
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Article Review	10 marks												
Total	40 Marks												
Practical Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>Practical Exam</td><td>20 marks</td></tr> <tr> <td>Viva</td><td>10 marks</td></tr> <tr> <td>Journal</td><td>10 marks</td></tr> <tr> <td>Discipline</td><td>05 marks</td></tr> <tr> <td>Total</td><td>50 Marks</td></tr> </table>	Attendance	05 marks	Practical Exam	20 marks	Viva	10 marks	Journal	10 marks	Discipline	05 marks	Total	50 Marks
Attendance	05 marks												
Practical Exam	20 marks												
Viva	10 marks												
Journal	10 marks												
Discipline	05 marks												
Total	50 Marks												

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1



CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE	COURSE NAME	SEMESTER
BTFS704	Environmental Impact Assessment	VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Environmental Pollution & Control Measures
Course Category	Professional Core
Course focus	Employability
Rationale	EIAs aim to identify and mitigate adverse environmental effects, promote sustainable development, and facilitate informed decision-making. Here are the key rationales for conducting Environmental Impact Assessments: Sustainable Development, Environmental Protection, Decision-Making Tool, Stakeholder Engagement, Legal and Regulatory Compliance, Risk Management, Public Awareness and Education. In summary, the rationale behind conducting Environmental Impact Assessments is to promote sustainable development, protect the environment, support informed decision-making, engage stakeholders, ensure legal compliance, manage risks, and raise public awareness. EIAs serve as a critical tool for integrating environmental considerations into planning processes, minimizing adverse environmental impacts, and promoting a more sustainable and resilient future.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	1: To identify the principles of Environment Impact Assessment 2: To critically evaluate the techniques for evaluating environmental



risks and impacts arising from industries
 3: To illustrate the purpose of an environmental impact assessment and environmental statement in relation to large developments.
 4: To represent the importance of technology and legislation in the process of EIA

Course Content (Theory)	Weightage	Contact hours
Unit 1: Basic Concept of environment, environmental impact, assessment of impacts EIA as a planning tool for Major Project Activities, EIA methodologies, screening and scoping criteria. Criteria for Selection of EIA Methodology, Rapid and Comprehensive EIA, Predictive Models for Impact Assessment. The purpose of an environmental impact assessment.	20%	11 hours
Unit 2: Definitions, introduction to Hazard Identification and Risk Assessment, Key-steps in performing Environmental Risk Assessment. Environmental Hazards, Prediction based scenarios of exposure, Risk characterization and Risk management. Opportunities and Challenges in ERAM.	20%	11 hours
Unit 3: Collection of baseline data, Assessment of impacts of physical, biological and socio – economic environment. Impact prediction tools/techniques such as Adhoc method, checklist method etc., Development of environment management plan and EIA report. Process of public participation/hearing in EIA, Resettlement and rehabilitation issues Review process	20%	11 hours
Unit 4: Definition, Sources of remote sensing information, useful software. Application of RS and GIS in the process of Assessment. EIA Case Studies. Introduction to various aspects of environmental modelling. Procedure to obtain environmental clearance (rule 14), sitting guideline of industries and areas to be avoided and Form V (environmental statement).	20%	12 hours
Instructional Method and Pedagogy: PPT, Video Presentation, Case Studies		

Course Outcomes	Blooms' Taxonomy	Blooms' Taxonomy Sub
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	Domain	Domain
CO1: Remember principles of Environment Impact Assessment CO2: Understand techniques for evaluating environmental risks and impacts arising from industries CO3: Evaluate various risks and their probable impacts on environment involved with different processes and processing plants CO4: Understand purpose of an environmental impact assessment and environmental statement in relation to large developments CO5: Understand importance of remote sensing and geographical information system in the process of EIA	Cognitive	

Learning Resources

1.	Reference Books: 1. L. W. Canter (1996) "Environmental Impact Assessment", Tata Mcgraw Hill Co, Singapore. 2. P. Wathern (1998) "Environmental Impact Assessment: Theory and Practice", Routledge, London and Newyork. 3. Y. Anjaneyulu and V. Manickam (2007) "Environmental Impact Assessment", 2nd Edition, B.S. Publication, Hyderabad. 4. S.C. Santra (2005) "Environmental Science", 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India. 5. S. K. Dhameja (2004) "Environmental Engineering and Management", S. K. Kataria& Sons, Delhi.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks

**Theory: Continuous
Evaluation Component
Marks**

Attendance	05 marks
MCQs	10 marks
Open Book Assignment	15 marks
Article Review	10 marks
Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE	COURSE NAME	SEMESTER
BTFS705	Fire & Safety in Major Accident Hazard Units	VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
4	0	0	4	4	0	0	4

Course Pre-requisites	Legislations Related to Fire & EHS, Safety Management II
Course Category	Professional Core
Course focus	Employability
Rationale	MAHUs are industrial facilities that handle hazardous substances in quantities that could result in significant consequences if accidents were to occur. Fire and safety measures in MAHUs aim to protect workers, the surrounding community, and the environment from the severe impacts of major accidents. Here are the key rationales for fire and safety in MAHUs: Prevention of Major Accidents, Protection of Human Life, Environmental Protection, Property Protection, Compliance with Regulations, Emergency Response Preparedness, Reputation and Stakeholder Confidence. In summary, fire and safety measures in major accident hazard units are essential to prevent major accidents, protect human life, preserve the environment, safeguard property, comply with regulations, prepare for emergencies, and maintain stakeholder confidence. These measures play a crucial role in ensuring the safe and responsible operation of MAHUs, mitigating risks, and reducing the potential impacts of accidents on workers, communities, and the environment.
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	1: To become familiar with different industrial processes and associated major accidents at industrial premises. 2: To appraise the major hazards at various MAH industries and facilities available to cope with the major accident. 3: To critically analyze preparedness, emergency planning and resources for high hazard industries. 4: To explain control measures and systems applied for controlling major accident hazards in special industries like nuclear, aviation and maritime port industries. 5: To become aware of statutory requirements pertaining to fire prevention and safety for MAH units.

Course Content (Theory)	Weightage	Contact hours
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Unit 1:

Definition of “Major Accident Hazard”, Major industrial hazards, Types and consequences of major industrial hazards – Explosions, Fire, Toxic releases Identification of major hazard Units and their hazardous substance, role of occupier in MAH organisations.

Identification and assessment of MAH units, Criteria and Classification of Threshold Quantities of hazardous materials, Applicability, respective rules (the major accident hazard control rules, MSIHC Rules or Rule 68-J,GFR ILO-C174 - Prevention of Major Industrial Accidents Convention, 1993) Introduction to On-site and off-site emergency plan.

20%

12 hours

Unit 2:

Raw materials and products used in Fertilizer & Chemical industries. Different units and processes in these industries, storage of LPG, bulk chlorine installations, Storage of anhydrous ammonia under pressure and ammonium nitrate in a large warehouse.

Chemical and fertilizer industries: Hazard Identification and Vulnerability Assessment of fire and explosion emergencies. Fire prevention and safety measures. Safety in design and operation. Chemical Emergencies. Emergencies involving extremely hazardous chemical substances and their effects.

Unit 3:

Functioning of Aviation Industry: Hazards in Airport, Protection & Types of Hangers, Refueling and Defiling in Air Cargo, Crash Fire Tender: Provision of Crash, Fire Tenders including Rapid Intervening appliances, their extinguishing media.

The maritime environment: introduction to docs and ship breaking industry. Characteristic of Shipbreaking Industries, vessel types, construction, Vessel plans, cargo vessel hazards & safety. general hazard associate with ship breaking industry, incident strategies & tactics training & planning, vessel fire incidents case-studies.

Nuclear industry: Radio Active Material – Basic Theory, Techniques of area and air monitoring. Techniques of personnel radiation protection. Sources and characteristics of radioactive waste and their types and their method of disposal. Accident management, Emergency preparedness and Decommissioning of Nuclear Power Plant (NPP). Fire prevention and protection systems in NPPs.

20%

12 hours

Unit 4:

Introduction to emergency plans, objectives of emergency plans, Formulation of the plan, Alarms and communication, emergency control center, implementation, mock-drills, review and testing. Implementation of major hazard control systems: Identification of major hazards, Setting priorities, Emergency planning – On-site and Off-site plan preparation, details to be furnished in the on-site and off-site emergency plan, Inspection of works, Training, Evaluation of major hazards, Actions arising from evaluation, Information to the public and employees. Types and Effects of Gas Dispersion: Types of Toxic Spills, Liquid Gas leak, basic calculation related to Radiation Effects, Blast wave Effects, Toxic Effects (fatalities).

20%

12 hours

Unit 5:

Role and responsibilities: Criteria (Identification) for the Plant to be under MAH unit, Role of the Management, Role of the Authorities, Role of the



Workers, Role of the Public. Role of Safety officer, fire officer/incident commander, emergency coordinating officer, local authorities, external agencies – police, fire and emergency service, medical/health service. Information and documentation: notification of major accident, information to be furnished regarding notification of a major accident, information to be given to persons liable to be affected by a major accident, collection, development and dissemination of information, information to be furnished in a safety report.

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Understand effects of major accidents at industrial premises CO2: Remember major hazards at aviation industry and facilities available to cope with the major accident CO3: Evaluate necessary measures to protect human health and the environment from the consequences of major accidents at maritime environment CO4: Evaluate control measures and systems applied for controlling major accident hazards in nuclear industries CO5: Understand critique the methods to contain and control incidents to minimize the consequences, and to limit damage to human health, the environment and property	Cognitive	

Learning Resources

1.	Reference Books: 1. ILO (1993) Major hazard Control, ILO. 2. K.U. Mistry () Fundamentals of Industrial safety and health, Siddharth Prakashan. 3. Sam Mannan (2004) Lees' Loss Prevention in the Process Industries_ Hazard Identification, Assessment and Control vol 1-3-Butterworth-Heinemann. 4. Geoff Wells (1997) Major Hazards and their management, Institution of Chemical Engineers.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks



Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
	Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS706A	COURSE NAME Fire Investigation	SEMESTER VII
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Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Smoke control system
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Course Category	Professional Elective
Course focus	Employability
Rationale	
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To demonstrate the investigation methods for determining causes of fire 2: To understand the role and responsibilities of first responders, safety of the scene and safety the fire investigator 3: To identify and interpret burn patterns recognizing the physical characteristics of arson fires and critically assess the evidence 4: To critically analyze fire investigation processes including the important roles and evidence associated with different fire safety agencies and personnel participating in fire investigation 5: To structure and critique a valid scientific fact-based fire investigation and a range of fire investigation reports from minor to major incidents

Course Content (Theory)	Weightage	Contact hours
Unit 1: History of fire investigation; Economic, moral and legal reasons for investigating fires. Management of the fire investigation: Investigative procedures, interviews and interview records, contemporaneous notebook/pocket book rules, scene photographs; issues of data protection, report writing; preparing a case file, rules of evidence.	20%	9 hours
Unit 2: Health and safety risk assessment prior to and during an investigation, operating safely within the Inner Cordon; Locating the scene of fire, identifying the point of ignition, radius of error, fire spread patterns, indications of slow and rapid fire growth, the impact of firefighting operations, post fire excavation of the scene; gathering evidence, collecting samples at the fire scene and ensuring continuity of evidence; Laboratory investigation of fire debris.	20%	9 hours
Unit 3: Services and appliances; Electricity; Smoking materials; Flying brands; Spontaneous ignition. Vehicle fire sources of ignition: Electrical, chemical heating, mechanical heating; fuel options.	20%	9 hours
Unit 4: Statistics motivation and methods; the analysis of hydrocarbon materials in cases of suspected arson; incendiaries. Typecasting in terms of method, age and sex; juvenile fire setters; strategies for combating arson. Wildfires: -Fire behaviour in an external environment; investigation methodology; scene search; burn indicators; typical wildfire causes.	20%	9 hours
Unit 5: Introduction to and demonstration of Mathematical Fire Modelling, Zone Models, Field Models, Models for Specialized Applications, the Modelling	20%	9 hours



applications/software, Fire Assessment, Documentation, Model Evaluation, Computer-based Models and scenario reconstruction.

Forensic Laboratory services:- Availability; general fire evidence; identification of volatile accelerants; chemical incendiaries; none fire-related criminal evidence. Role of forensic officer at the fire scene, tool-kit of a forensic investigator. Methods of evidence/sample collection, transportation and preservation.

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies, Site Visits

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Remember the principles and basic methods of fire investigation CO2: Understand roles and responsibilities of first responders, safety of the scene and safety the fire investigator CO3: Evaluate the physical characteristics of arson fires and critically assess the evidence recovered and wanted by different agencies. CO4: Apply fire investigation processes including the important roles and evidence associated with different fire safety agencies and personnel participating in fire investigation. CO5: Analyze a range of fire investigation reports from minor to major incidents.	Cognitive	

Learning Resources	
1.	Reference Books: - De Haan, J. (2007) Kirks Fire Investigation, 6th edition, Prentice-Hall. - Niamh Nic Daeid (2004) Fire Investigation, CRS Press. - John J. Lentini (2013) Scientific Protocols for Fire Investigation, CRC Press. R. Chandler (2009) Fire Investigation, Delmar Cengage Learning.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks

**Theory: Continuous Evaluation Component Marks**

Attendance	05 marks
MCQs	10 marks
Open Book Assignment	15 marks
Article Review	10 marks
Total	40 Marks

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

COURSE CODE BTFS706B1				COURSE NAME Process Safety				SEMESTER VII			
Teaching Scheme (Hours)				Teaching Credit							
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit				
3	0	0	3	3	0	0	3				



Course Pre-requisites	Safety Engineering
Course Category	Professional Elective
Course focus	Employability
Rationale	
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To comprehend the process in textile industries and its safety measures 2: To comprehend the process in fireworks industries and its safety measures 3: To comprehend the process in cement & brick manufacturing industries and its safety measures 4: To comprehend the process in paper & pulp industries and its safety measures 5: To comprehend the process in glass & quartz industries and its safety measures

Course Content (Theory)	Weightage	Contact hours
Unit 1: UNIT I – Introduction to Process Safety Management History & evolution of PSM, Key industrial accidents (Bhopal, Texas City, Flixborough), Definitions: Process Safety vs. Personal Safety, Importance of Safety Culture, Overview of PSM Frameworks: OSHA PSM (29 CFR 1910.119), API RP 750, Introduction to CCPS ;Risk Based Process Safety model (4 Pillars) Introduction to API RP 754 (Tiers 1–4-Performance Indicators).	20%	9 hours
Unit 2 – Regulatory Frameworks & Standards Indian Laws & Rules: MAH Rules (Manufacture, Storage, and Import of Hazardous Chemicals), MISH Rules (Model Industrial Safety and Health), Relevant IS Standards (e.g., IS 15656, IS 14489, IS 18001), International Regulations & Standards: OSHA PSM Standard (29 CFR 1910.119), EPA RMP Rule (USA), ISO 45001 (OH&S), IEC 61511 (SIS for process industries)	20%	9 hours
Unit 3 – CCPS 20 Elements of Risk-Based Process Safety (RBPS) Organized under 4 Pillars: Pillar 1: Commit to Process Safety-Process Safety Culture, Compliance with Standards, Process Safety Competency, Workforce Involvement, and Stakeholder Outreach. Pillar 2: Understand Hazards and Risks- Process Knowledge Management, Hazard Identification and Risk Analysis (HIRA), Human Factors Pillar 3: Manage Risk-Operating Procedures, Safe Work Practices, Asset Integrity & Reliability, Contractor Management, Training and Performance Assurance, Management of Change (MOC), Operational Readiness, Conduct of Operations, Emergency Management and Response Pillar 4: Learn from Experience - Incident Investigation	20%	9 hours



Unit 4: – Risk Assessment & Hazard Identification Tools Risk Identification & Categorization, Bow-Tie Analysis, LOPA (Layer of Protection Analysis), Safety Integrity Levels (SIL), Quantitative Risk Assessment (QRA), HAZOP (Hazard and Operability Study) - Based on ICI HAZOP Guideline (NSC, Mumbai), Nodes, guide words, deviations, causes & consequences, Workshop-format case study on HAZOP for a storage tank/reactor.	20%	9 hours
Unit 5: Case Studies & Future of PSM Analysis of real-world incidents using RCA and Bow-Tie, Metrics and KPIs (with emphasis on API RP 754 – Tier 1–4 indicators), Auditing PSM programs, Management Review and Continuous Improvement, Digitalization and Industry 4.0 in Safety, Use of Iot, AI, dashboards for predictive safety. Sustainability in Process Safety, Linking safety performance with environmental and social goals.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies, Site Visits

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
- CO1: Understand PSM fundamentals and history - CO2: Explain global and Indian process safety frameworks - CO3: Apply CCPS 20-element model to real-world contexts - CO4: Analyze hazard identification and risk assessment tools - CO5: Evaluate performance using API RP 754 indicators - CO6: Design and audit PSM programs using data and case studies	Cognitive	

Learning Resources

1.	Reference Books: 1. CCPS: “Introduction to Process Safety for Undergraduates and Engineers” 2. CCPS: Guidelines for Risk-Based Process Safety 3. API RP 754: Process Safety Performance Indicators 4. ICI HAZOP Guideline Booklet – NSC, Mumbai 5. OSHA 29 CFR 1910.119 – PSM Standard 6. EPA RMP Rule 7. MAH/MSIHC Rules (India), BIS IS Standards (IS 15656, IS 14489)
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	8. Kletz, Trevor – What Went Wrong? Case Histories
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table border="1"> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks
Attendance	05 marks										
MCQs	10 marks										
Open Book Assignment	15 marks										
Article Review	10 marks										
Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3
CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None



COURSE CODE	COURSE NAME	SEMESTER
BTFS706C	Wastewater Engineering	VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	0	0	3	3	0	0	3

Course Pre-requisites	Environment Pollution and control measures
Course Category	Professional Elective
Course focus	Employability
Rationale	
Course Revision/ Approval Date:	5 th March 2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1: To define the types and quantity of water resources available globally 2: To differentiate the types and sources of pollutants in various effluents 3: To describe the purpose of monitoring effluent discharges and the measuring techniques used 4: To demonstrate the design criteria for various effluent load and various types of industries 5: To interpret the minimum discharge standards and environmental legal requirements applicable to various industries

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction, Hydrological Cycle, types of water resources, Methods for Managing Water Resources, Utilization of rainwater. National and global freshwater availability scenario, water demand, factors affecting water demand. Origin of Wastewater, Types of Water Pollutants and their Effects. Cost estimation of Wastewater Treatment.	20%	9 hours

Unit 2: The purpose of water monitoring and effluent discharges. Sampling of liquid effluents: grab sampling, continuous monitoring. The meaning of and the possible effect on the water environment of: dissolved oxygen (DO), Conductivity or Specific Conductance, Hardness (Total), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total oxygen demand (TOD), pH scale, total solids (TS), total suspended solids, total dissolved solids, turbidity, odour (TON), Oil and Grease.	20%	9 hours
Unit 3: Principal types of water pollutants: physical (solids, thermal, radiological), chemical, biological, pathogens and disease, nuisance organism. Distribution	20%	9 hours



system components, Wastewater collection, Types of collection systems. Design of water and wastewater pumping systems. Physico-chemical Methods of Treatment for Industrial Wastewater, Oxidation Technologies for Wastewater Treatment, Advanced Treatment Technology.		
Unit 4: Detailed design of water treatment plant: Design of physico-chemical units, chambers, tanks and ponds. Selection of Design Flowrates and Mass Loadings, Design Considerations of Flow and Constituent Load Equalization. Design criteria: Treatment Process Design Considerations, Important Factors in Process Selection, Treatment Process Flow Diagrams, Physical unit processes, Chemical unit processes, biological treatment, Disinfection processes or advance water treatment, sludge treatment. Achievement of: Zero Liquid Discharge, Evaporation, Energy consideration in wastewater treatment.	20%	9 hours
Unit 5: Importance of maintaining prescribed standard parameters, introduction to wastewater remediation techniques. Introduction to and importance of The Water (Prevention and Control of Pollution) Act, 1974, The Water (Prevention and Control of Pollution) Rules, 1975, Standards for Emission or Discharge of Environmental Pollutants from various Industries.	20%	9 hours

Instructional Method and Pedagogy:

PPT, Video Presentation, Case Studies, Site Visits

Course Outcomes	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
CO1: Remember the types and quantity of water resources available globally CO2: Remember types and sources of pollutants in various effluents CO3: Understand purpose of monitoring effluent discharges and the measuring techniques used CO4: Evaluate design criteria for various effluent load and various types of industries CO5: Understand minimum discharge standards and environmental legal requirements applicable to various industries	Cognitive	

Learning Resources

1.	Reference Books: 1. Metcalf and Eddy (2007) Wastewater Engineering: Treatment, and Reuse, Tata McGraw Hill. 2. A.D. Patwardhan (2017) Industrial Wastewater Treatment, PHI Learning. 3. M. N. Rao and A. K. Dutta (2020) Wastewater Treatment 3Edn., Oxford &Ibh Publishing.
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	4. Anamika Srivastava (2018) Wastewater Treatment and Water Management: Water Treatment and Management, Notion Press; 1st edition.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

Evaluation Scheme	Total Marks										
Theory: Mid semester Marks	20 marks										
Theory: End Semester Marks	40 marks										
Theory: Continuous Evaluation Component Marks	<table> <tr> <td>Attendance</td><td>05 marks</td></tr> <tr> <td>MCQs</td><td>10 marks</td></tr> <tr> <td>Open Book Assignment</td><td>15 marks</td></tr> <tr> <td>Article Review</td><td>10 marks</td></tr> <tr> <td>Total</td><td>40 Marks</td></tr> </table>	Attendance	05 marks	MCQs	10 marks	Open Book Assignment	15 marks	Article Review	10 marks	Total	40 Marks
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MCQs	10 marks										
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Total	40 Marks										

Mapping of PSOs& COs

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	0	0
CO2	1	3	0	1
CO3	1	3	0	0
CO4	1	3	0	1
CO5	1	2	0	0
Avg.	1	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	2	2	2	3	0	1	3	3
CO2	2	2	0	3	2	3	2	3	1	1	1	3
CO3	3	1	0	0	2	2	2	3	0	1	3	3

**B.Tech Fire &EHS****Course Curriculum****Academic Year 2022-23**

CO4	3	1	0	0	2	2	2	3	0	1	3	3
CO5	2	2	0	3	2	3	2	3	1	1	1	3
Avg.	3	1	0	1	2	2	2	3	0	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

**Teaching Scheme****Semester –VIII**

Sr. No .	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTFS801	Major Project	0	16	0	16	0	8	0	16					100	100
0		Total														

Note: L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester



VAC 201		Tinkering & Mentoring		L	T	P	C
				0	0	2	1
Total Credits: 1		Total Hours in semester : 30		Total Marks: 100			
1	Course Pre-requisites: NA						
2	Course Category: Value Added Course						
3	Course Revision/ Approval date						
4	Course Objectives						
4.1 To provide hands-on experience in problem-solving and prototyping through group-based tinkering projects.							
4.2 To develop entrepreneurial, creative, and critical thinking skills among students.							
4.3 To enhance students' understanding of industry standards, intellectual property rights, and ethical practices.							
4.4 To foster collaboration, teamwork, and communication skills through multidisciplinary group projects.							
4.5 To expose students to real-world case studies, expert insights, and best practices in innovation and sustainability							

Course Content	Weightage	Contact hours	Pedagogy
Unit 1 Introduction to Entrepreneurship: Understanding the concept, need, myths, and types of entrepreneurship. Importance of entrepreneurship in innovation and problem-solving.	10%	3	Expert talks, brainstorming sessions, and case studies.
Unit 2 Idea Generation and Feasibility Study: Identifying opportunities, developing Minimum Viable Products (MVP), assessing product-market fit, and pricing strategies.	20%	6	Interactive mentoring sessions, group brainstorming, and discussions.
Unit 3 Intellectual Property Rights (IPR): Overview of patents, copyrights, trademarks, and technology transfer. Importance of IPR in securing innovation.	10%	3	Expert talks and group discussion on real-life case studies.
Unit 4 Values, Ethics, and Standards: Importance of values in professional and personal growth. Sustainable solutions, eco-friendly systems, and understanding of BIS standards and their role in innovation	10%	3	Expert talks and group discussion



and industry.			
Unit 5: Tinkering and Prototyping: Hands-on project work in groups to develop solutions for identified problems. Projects will include: Physical Prototypes for engineering and science students. Conceptual Modules (e.g., software, programs) for IT students. Business Cases or Models for management students. Students will work closely with faculty mentors to brainstorm, design, and create functional prototypes or models.	50%	15	Practical tinkering sessions, faculty mentoring

Learning Resources	
1.	Textbook: N/A – The course relies on expert experiential learning and practical activities.
2.	Reference books 1. "The Lean Startup" by Eric Ries 2. "Zero to One" by Peter Thiel 3. "Intellectual Property Rights: Unleashing the Knowledge Economy" by Prabuddha Ganguli
3.	Journal Articles from Harvard Business Review and MIT Sloan Management Review.
4.	Periodicals Business Standard, Economic Times, and Forbes articles on entrepreneurship and innovation.
5.	Other Electronic resources TED talks, and online courses on prototyping and entrepreneurship.

Sr No	Evaluation Component	Marks
1	Continuous Evaluation Component	50
A	Attendance	10
B	Progress Report Presentation - Problem identification, Ideation & Initial Design	15
C	Progress Report Presentation - Progress Review and Prototype Development	15
D	Expert Session Takeaway Report	10
2	End Semester Component	50
A	Final Project Presentation and Demonstration	30
B	Viva-Voce	20



Course Outcomes	1. Students will understand entrepreneurial concepts, including business plans, feasibility studies, and product-market fit.
	2. Students will gain insights into intellectual property rights, ethical practices, and sustainability in innovation.
	3. Students will work effectively in teams, demonstrating collaboration, communication, and leadership skills.
	4. Students will connect theoretical knowledge with practical applications through expert talks and hands-on tinkering activities
Additional Information to enhance learning	Expert Talks: Delivered by professionals and industry leaders on topics such as entrepreneurship, IPR, and sustainability. Hands-On Tinkering Projects: Guided by faculty mentors, with resources provided by GUIITAR.