Bachelor of Science in Fire & Safety

SEMESTER 1							
Sr No	Course code	Course Name	TEACHING SCHEME				
			L-T-P	CREDITS	MARKS		
					Imternal	External	Total
1	BSCFS101	Fundamentals of English	4-0-0	4	30	70	100
2	BSCFS102	Fundamentals of chemistry	4-0-0	4	30	70	100
3	BSCFS103	Fundamentals of Fire & Safety	4-0-0	4	30	70	100
4	BSCFS104	Foundation Course	4-0-0	4	30	70	100
5	BSCFS105	Physical training & Drills - 1	0-0-2	2	20	30	50
6 Any One	BSFS106P	Discipline Specific Generic Electives -physics 1	4-0-0	4	30	70	100
	BSCFS106M	Discipline Specific Generic Electives - Maths 1	4-2-0	6	30	70	100
7	BSCFS107	Fundamentals of chemistry Lab	0-0-2	2	20	30	50
8	BSCFS108	Fundamentals of Fire & Safety Lab	0-0-2	2	50	0	50
9	BSCFS109	Foundation Course	0-0-2	2	50	0	50
10	BSCFS110	Visit to Fire & Safety Laboratory & Industries to understand importance of equipment	0-0-4	4	30	70	100
11 Any One	BSCFS111P IF YOU SELECT SCFS106P	Discipline Specific Generic Electives -physics 1/maths -1	0-0-2	2	20	30	50
	BSCFS111M IF YOU SELECT SCFS106M	Discipline Specific Generic Electives -Maths -1	0-0-2	2	50	0	50
		Total		**34**			**850**

SEMESTER 2							
Sr No	Course code	Course Name	TEACHING SCHEME				
			L-T-P	CREDITS	MARKS		
					Imternal	External	Total
1	BSCFS201	Communication Skills in English	4-0-0	4	30	70	100
2	BSCFS202	Chemistry of combustion	4-0-0	4	30	70	100
3	BSCFS203	Rescue Techniques & First Aid	4-0-0	4	30	70	100
4	BSCFS204	Manual & Portable Firefighting Equipment	4-0-0	4	30	70	100
5	BSCFS205	Physical Training & Drills - 2	0-0-2	2	20	30	50
6	BSFS206P	Discipline Specific Generic Electives - physics 2	4-0-0	4	30	70	100
	BSCFS206M	Discipline Specific Generic Electives – Maths 2	4-0-0	4	30	70	100
7	BSCFS207	Chemistry of combustion Lab	0-0-2	2	20	30	50
8	BSCFS208	Rescue Techniques & First Aid	0-0-2	2	20	30	50
9	BSCFS209	Manual & Portable Firefighting Equipment	0-0-2	2	20	30	50
10	BSCFS210	Internship	0-0-4	4	30	70	100
11	BSCFS211P	Discipline Specific Generic Electives - physics 2	0-0-2	2	20	30	50
	BSCFS211M	Discipline Specific Generic Electives - Maths -2	0-0-2	2	50		50
		Total		**34**	**280**	**570**	**850**

SEMESTER 3					
Sr No	**Course code**	Course Name	TEACHING SCHEME		
			L-T-P	CREDITS	MARKS
1	BSCFS301	Entrepreneurship Development	4-0-0	4	100
2	BSCFS302	Internship	0-0-4	4	100
3	BSCFS303	Physical Training & Drills - 3	0-0-2	2	50
4	BSCFS304	Safety Engineering and its Industrial Applications	4-0-2	6	150
5	BSCFS3-5	Town Planning & Safety in Construction Industry	4-0-2	6	150
6	BSCFS306	Safety in Oil & Gas Industry	4-0-2	6	150
7	BSCFS307	Professional elective -1	4-0-2	6	150
TOTAL				**32**	**850**

SEMESTER 4					
Sr No	**Course code**	Course Name	TEACHING SCHEME		
			L-T-P	CREDITS	MARKS
1	BSCFS401	Environmental Science	4-0-0	4	100
2	BSCFS402	Internship	0-0-4	4	100
3	BSCFS403	Physical Training & Drills - 4	0-0-2	2	50
4	BSCFS404	Automobile Technology & Different Fire Tenders	4-0-2	6	150
5	BSCFS405	Fire Protection Systems – Design & Application	4-0-2	6	150
6	BSCFS406	Electrical Safety	4-0-0	4	100
7	BSCFS407	Chemical Safety for Industries	4-0-0	4	100
8	BSCFS408	Professional elective -1	4-0-0	4	100
			TOTAL	**34**	**850**

SEMESTER 5					
Sr No	**Course code**	Course Name	TEACHING SCHEME		
			L-T-P	CREDITS	MARKS
1	BSCFS501	Disaster Risk Management	240-0	4	100
2	BSCFS502	Internship	0-0-0	2	50
3	BSCFS503	Physical Training & Drills - 5	0-0-2	2	50
4	BSCFS504	Fire Fighting Operations	4-0-2	6	150
5	BSCFS505	Industrial Safety Management	4-0-0	4	100
6	BSCFS506	Special Fire Suppression & Fire Detection Systems	4-0-2	6	150
7	BSCFS507	Legislation related to Fire & Safety	4-0-0	4	100
8	BSCFS508	Special Fire hazards (Marine & Aviation)	4-0-2	6	150
		Total		**34**	850

SEMESTER 5					
Sr No	**Course code**	Course Name	TEACHING SCHEME		
			L-T-P	CREDITS	MARKS
1	BSCFS601	Indian Constitution	4-0-0	4	100
2	BSCFS602	Final year project	0-0-0	6	150
3	BSCFS603	Safety Audits & Risk Assessment	0-0-2	2	50
4	BSCFS604	Industrial Risk Assessment & Control	3-1-0	4	100
5	BSCFS605	Industrial Hygiene & health	4-0-0	4	100
6	BSCFS606	Building Fire Prevention & Protection Measures	4-0-2	6	150
7	BSCFS607	Industrial Safety Management-2	4-0-0	4	100
8	BSCFS608	Case studies, Fire Scene Reconstruction & Investigation	3-1-0	4	100
		Total		**34**	850

BS\CFS101	Fundamentals of English	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Lecture & Practical Hours in semester: 30hrs**		**Total Marks:100(30+70)**		

1	**Course Pre-requisites:** Students should have basic knowledge of English language and grammar.
2	**Course Category: Ability Enhancement compulsory courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	To emphasize the development of listening and reading skills among learners.
2	To equip them with writing skills needed for academic as well as workplace context.
3	To enable learners to develop their basic communication skills in English.
4	To make the students more confident in day-to-day life.
5	To help them get good marks in competitive exams.

Course Content	Weightage	Contact hours	Pedagogy
Theory: **Language Basics** Parts of speech, word formation, prefix-suffix, synonyms, antonyms, homophones and standard abbreviations	20%	6 hours	Presentation, Video presentation

Unit 2: **Elementary Reading/Writing Skills** Types of the sentences, structures of the sentences, use of phrases and clauses, punctuation, creative writing and coherence, comprehension, essay/paragraph writing, precise writing	30%	9 hours	Presentation, Video presentation
Unit 3: **Elementary Spoken Skills** Greetings, farewell and introduction, making an apology, accepting an apology, making an appointment, JAM, group discussion, debate, public speaking	30%	9 hours	Presentation, Video presentation
Unit 4: **Practicing and identifying the Common Error** Tense, subject-verb agreement, noun-pronoun agreement, articles, prepositions, modal auxiliaries, voice, reported speech.	20%	6 hours	Presentation, Video presentation

LEARNING RESOURCES

TEXTBOOKS	1. Essential English Grammar Raymond Murphy (2000) Cambridge.
REFERENCE BOOKS	1. Murphy, Raymond "Murphy's English Grammar with CD" Cambridge University Press, 2004. 2. Thorpe, Edgar and Showick Thorpe "Basic Vocabulary" Pearson Education India, 2012. 3. Green, David. "Contemporary English Grammar Structures and Composition" MacMillan Publishers, New Delhi, 2010. 4. Wren &Martin (2001), English Grammar & Composition, New York.
Journals & Periodicals:	1. 'The Journal' Basic English Grammar 2. 'Fluent U' English Language and Cultural Journal 3. 'The Journal of English Academics' 4. 'Elsevier' The research on language
Other Electronic Resources:	1. Index Noedicus : A Cumulative Index to English Language Periodicals 2. The Illustrated English Language Periodicals Other Electronic resources: Jamboard, Google Classroom, Wordsworth - Language Software, Google form.

Evaluation Scheme	**Total Marks 70 marks**
Mid semester Marks	20 marks

End Semester Marks	70 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1.To enable learners to develop their basic communication skills in English	

Course Outcomes	2. Enable the students to communicate professionally
	3. Enable students to get the good marks in competitive exams
	4. Enable students to be confident reader
	5. Enable students to speak the language in day-to-day life.

BSCFS105	**Physical Training & Drills - 1**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**2**
Total Credits:2	**Total Hours in semester :60hrs**		**Total Marks:50(20+30)**		

1	**Course Pre-requisites: nil**
2	**Course Category: Skill enhancement courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	To provide proper instructions for Physical training & Squad Drills
2	Introduction to Ground Exercise
3	Introduction to Fire Extinguisher Portable
4	Introduction to Firemanship
5	Introduction to knots & Lines

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1: Aim of Drill, the principles of good instruction, notes for drill instructors, definitions, timing of words command, technique of instruction & arrangement and conclusion of instructional periods.	20%	6 hrs	Practical training & demonstration
Unit 2: Position of the Fireman at attention, stand at ease, stand easy turning and inclining saluting at the halt, saluting on the march, courtesy, terminology, clarification, correction o faults, inspection, handling a squad, questions and communication drill and manual drill.	20%	6 hrs	Practical training & demonstration
Unit 3: Introduction to Portable Fire Extinguisher types and application.	20%	6 hrs	Practical training & demonstration

Unit 4: Introduction to hydrants, monitors, and fixed firefighting facilities available in the campus and fire water system.	20%	6 hrs	Theory & Practical training & demonstration
Unit 5: Introduction to different types of Knots & lines its application.	20%	6 hrs	Practical training & demonstration

LEARNING RESOURCES

TEXTBOOKS	• Fire Service Manuals U.K.; • NFPA U.S.A; • Fire Drill Manual by NFSC • Scaling, Type of Equipment and Training of Fire Services – National Disaster Management Guidelines

Evaluation Scheme	**Total Marks 50 marks**
Mid semester Marks	20marks
End Semester Marks	30 marks

BSCFS102	Fundamentals of chemistry	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Lecture Hours in semester :45 hrs + 60hrs**		**Total Marks:100(30+70)**		

1	**Course Pre-requisites:** Nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Understand basic of inorganic chemistry
	Understand basics of oxidation reduction reaction
3	Understand basics of liquid & solid state
4	Understand basics of organic chemistry

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Periodicity of Elements s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s & p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.	20%	15 hours	Chalk boardNotes

Unit 2: Oxidation-Reduction Redox equations, Standard Electrode Potential and its application to inorganic reactions.	20%	. 5	Classroom Lecture, Case Studies, Quizzes, Presentations, Role Play
Unit 3: Liquid state Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.	20%	12	Lecture, Quiz, discussion, Presentation, Video, Chalk Board
Unit 4: Solid state Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law,	20%	6	Lecture, Quiz, discussion, Presentation, Video, Chalk Board
Unit 5: Basics of Organic Chemistry Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electrometric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.	20	7	Chalk boardNotes

LEARNING RESOURCES

TEXTBOOKS	Textbook: 1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991. 2. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford,1970 3. Ball, D. W. Physical Chemistry Thomson Press, India (2007) 4. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004) 5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 6. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education) 7. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London,1993
REFERENCE BOOKS	
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	20 marks	
End Semester Marks	70 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Understand basic of inorganic chemistry
	Understand basics of oxidation reduction reaction
	Understand basics of liquid & solid state
	Understand basics of organic chemistry

BSCFS107	Fundamentals of chemistry Lab	L	T	P	C
		0	0	2	2
Total Credits:2	**Total Lecture Hours in semester : 60hrs**		**Total Marks:50(20+30)**		

1	**Course Pre-requisites:** Nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Understand basic of inorganic chemistry
	Understand basics of oxidation reduction reaction
3	Understand basics of liquid & solid state
4	Understand basics of organic chemistry

List of Experiments:			
1. Surface tension measurements. a. Determine the surface tension by (i) drop number (ii) drop weightmethod. b. Study the variation of surface tension of detergent solutions with concentration. 2. Viscosity measurement using Ostwald's viscometer. a. Determination of viscosity of various organic liquids at roomtemperature. b. Study the variation of viscosity of sucrose solution with the concentration of solute.			

3. pH metry. a. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide Any other experiment carried out in the class 4. Spotting of mono-functional Organic Compounds via elemental analysis and functional group analysis. 5. Determination of boiling point of liquid compounds. (Boiling point lower than and more than 100 °C by distillation and capillary method) 6. Acid-Base Titrations • Simple acidimetry-Alkalimetry • Estimation of carbonate and bicarbonate present together in a mixture Estimation of carbonate and hydroxide present together in			

LEARNING RESOURCES

Evaluation Scheme	**Total Marks 100 marks**	
Journal	10 marks	
Practical Examination Marks	30 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Viva	5 MARKS

BSFS103	FUNDAMENTALS OF FIRE & SAFETY	L	T	P	C
		4	2	0	6
Total Credits:6	**Total Hours in semester :45hrs**		**Total Marks:150**		

1	**Course Pre-requisites: Nil**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Understand the challenges to safety in built and industrial environment and approaches to addressing the same.
2	Become aware of the history and current role of safety related legislation and role of agencies involved with implementation.
3	Understand different design approaches for addressing fire and safety challenges in the built environment
4	Become familiar with current fire & safety engineering and management concepts and practices followed in the industry

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Challenges to safety in built environment, types of hazards likely to cause harm (fire, burns, electric shock, falls), natural disasters, fatalities involving hazardous environments. Approach to addressing fire and safety challenges at organization and national level.	25%	12 +06 hours	Presentation, Video presentation
Unit 2: The Concept of industrial safety, its need, nature and importance. Focus on Human resource, and 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%	9+6 hours	Presentation, Video presentation

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, etc., in fire & safety	20%	9+8 hours	Presentation, Video presentation
Unit 4: Design approaches for fire and safety, NFPA fire safety concepts tree, fire safety design objectives, strategies and tactics; fire prevention, control, detection and alarm, suppression, managing the exposed. Code based and performance-based design approaches – their advantages and shortcomings.	20%	7 +4 hours	Presentation, Video presentation
Unit 5 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.	20%	8+6 hours	Presentation, Video presentation Chalk board Notes

LEARNING RESOURCES

TEXTBOOKS	• Cote, Arthur, Section 1, Fire protection Handbook, 20th Edition, NFPA • Handbook of Industrial Safety by K.U. Mistry, Siddarth Prakashan, Gujarat • Industrial Accident Prevention by H.W. Heinrich, McGraw Hill Book Co. • Techniques of Safety Management by Dan Pederson. • Purandare D.D. Handbook on Industrial Fire Safety, P&A Publications
REFERENCE BOOKS	• Cheunisinoff & Graffia, Environmental Health & Safety Management, Reprint Jaico Publishing House. • Tarafdar, Industrial Safety Management

Journals & Periodicals:	NIL
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	20 marks

End Semester Marks	70 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Assignment	30 Marks
	Presentation/ miscellaneous activities	8 MARKS
	Skill enhancement activities / case study	7 marks
Course outcomes	• Students will understand the fire and safety challenges faced by the built and industrial environment, and the current approaches taken to address the same.	
	• 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.	
	• Students will be able to explain the different design approaches for addressing the fire & life safety challenges in built and industrial environments.	

	• Students will become aware of the different engineering and management concepts applied for addressing fire and safety risks in industrial scenarios.

BSPY105	PHYSICS - I	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Hours in semester: 60hrs +30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Understanding of Science subjects up to school-level
2	**Course Category: Generic Elective**
3	**Course Revision/ Approval Date:**
4. **Course Objectives:**	

1	To impart basic understanding of the commonly used Physical principles.
2	To inculcate good habits related to designing and performing experiments.
3	To introduce students to the popular Physics virtual labs.
4	To familiarize students to basic concepts of Mechanics, Thermodynamics, and Electrostatics
5	To introduce the students to basic concepts of problem-solving in Physics

Course Content	Weightage	Contact hours	Pedagogy

Unit 1: **Laws of Motion** Physical quantities and their dynamics: definitions and dimensions; vectors and scalars; concept of displacement, velocity, acceleration, angular momentum, torque, force, power, work, energy, and the relation between these physical quantities; elastic and inelastic collisions. Newton's laws of motion. Gravitation and weightlessness.	20%	12 hours	Powerpoint Presentation, Classroom Discussions, Virtual Labs
Unit 2: **Oscillations** Simple harmonic motion. Amplitude, period, frequency and wavelength. Kinetic and Potential Energy, Total Energy, and their time averages. Damped oscillations. Fluids: diffusion, dissipation, random walks and directed motions; Reynolds number, buoyant forces, Bernoulli's equation, viscosity, turbulence, surface tension, adhesion.	20%	4 hours	Hands on activities/ Job preparations
Unit 3: **Elasticity of materials** Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum - Determination of Rigidity modulus and moment of inertia - q, η and σ by Searle's method.	20%	4 hours	Hands on activities/Job preparations

Unit 4: **Laws of Thermodynamics** Basic laws; kinetic theory of gases; conduction, convection, and radiation; relations between pressure, volume and temperature; concept of thermal equilibrium, heat, temperature, internal energy, entropy, temperature and free energy, enthalpy. Introduction to laws of Thermodynamics.	20%	8 hours	Hands on activities/Job preparations
Unit 5: **Laws of Electrostatics** Basic laws, conductors and insulators, basic electrical quantities: current, voltage and power, Ohm's law and calculations related to simple resistor circuits, electric field and potential, energy of charges, ionic conductance; electrolyte conductivity, capacitors and capacitance, dielectrics.	20%	8 hours	Hands on activities/Job preparations

LEARNING RESOURCES	
TEXTBOOKS	1. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986, Addison-Wesley. 2. Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill. 3. Electricity and Magnetism, D. C. Tayal, 1988, Himalaya Publishing House. 4. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill. 5. Practical Physics. G. L. Squires. 4/e, 2001, Cambridge University Press.
REFERENCE BOOKS	1. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley. 2. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
Journals & Periodicals:	1. Journal of Undergraduate Reports in Physics (JURP) 2. Journal of Young Investigators (JYI) 3. Columbia Undergraduate Science Journal (CUSI) 4. Student Journal of Physics 5. Indian Journal of Physics
Other Electronic Resources:	Feynman Lectures in Physics: https://www.feynmanLectures.caltech.edu/
Evaluation Scheme	**Total Marks 100 marks**

Mid semester Marks	20 marks	
End Semester Marks	50 marks	
	CATEGORY	**MARKS**
	Attendance	5 marks

Continuous Evaluation Marks (20 Marks)	Quiz	5 marks
	Skill enhancement activities / case study	5 marks
	Presentation/ miscellaneous activities	5 marks
Course Outcomes	1. Students will be able to apply commonly known principles of Physics to various phenomena they learn in their course of studies.	
	2. Students will be acquiring good experimental skills, that help them to design & perform experiments.	
	3. Students will be able to utilize the virtual lab facilities.	
	4. Students will be able to understand and work on related case studies.	
	5. Students will gain basic problem-solving and reasoning skills in Physics.	

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BSCFS111P	PHYSICS - I	L	T	P	C
		0	0	2	2
Total Credits:2	**Total Lecture Hours in semester : 60hrs**		**Total Marks:50(20+30)**		

1	**Course Pre-requisites:** Nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To impart basic understanding of the commonly used Physical principles.
2	To inculcate good habits related to designing and performing experiments.
3	To introduce students to the popular Physics virtual labs.
4	To familiarize students to basic concepts of Mechanics, Thermodynamics, and Electrostatics
5	To introduce the students to basic concepts of problem-solving in Physics

List of Experiments:

Practical:

1) Error Analysis-I: (i) Uncertainties and error propagation. (ii) use of significant figures in the propagation of uncertainty. (iii) Plotting of graph and curve fitting.
2) Error Analysis-II: (i) Combining and reporting uncertainties in experimental measurements. (ii) Estimating uncertainties in an averaged measurement

3) Bar-Pendulum - Measurement of the value of acceleration due to gravity.
4)Moment of Inertia: Determination of the moment of inertia of an irregular body about an axis passing through its centre of gravity and perpendicular to its plane.

5) Torsional Pendulum: To determine the moment of inertia of the given disc using torsion

pendulum, with identical masses. 6) Free Vibration of spring mass system in Virtual lab: To obtain the natural frequency of the spring-mass system and observe its response to an initial disturbance and the type of the system based on damping ratio. 7) Verification of Newton's law of cooling: Study the relationship between the temperature of a hot body and time by plotting a cooling curve. 8)Measurement of charge and discharge characteristics of a capacitor. 9) Young's Modulus of metal bar: To determine the young's modulus of elasticity of given material. 10)Young's Modulus of a wire: To determine the young's modulus of elasticity of given material.			

LEARNING RESOURCES

Evaluation Scheme	**Total Marks 100 marks**	
Journal	10 marks	
Practical Examination Marks	30 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Viva	5 MARKS

BSMA106M	Mathematics-I	L	T	P	C
		4	2	0	6
Total Credits:6	**Total Hours in semester :75 hrs+15 hrs**		**Total Marks:150**		

1	**Course Pre-requisites:** Knowledge of basic precalculus concepts and skills.
2	**Course Category: Discipline Specific Generic Elective**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Demonstrate knowledge of basic precalculus concepts and skills.
2	Evaluate limits, recognize continuity and use the properties of continuous functions.
3	Find derivatives of algebraic and trigonometric functions using the definition or basic rules of differentiation.
4	Find rates of change, solve related rate problems, Find extreme values in optimization problems.
5	Apply the concepts and methods described in the syllabus, solve problems using linear algebra and will know a number of applications of linear algebra. Also the text and class discussion will give the concepts, methods and applications.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Trigonometry and its identities, inverse trigonometric functions, Concept of a limit and functions, Continuity and derivative of elementary functions, Rules of differentiation (without proof), Chain rule (without proof), differentiation of implicit functions.	20%	15 hours	Presentation, Video presentation,Chalk board,Notes

Unit 2: Indeterminate forms, L. Hospital's rules, Applications of Derivatives: maxima and minima of function. Standard integration formulae, Integration by the method of substitution.	20%	15 hours	Presentation, Video presentation, Chalk board, Notes
Unit 3: Integration by parts, Integration by the method of partial fractions, definite integration, fundamental theorem of calculus Applications of Integrations: Area and volume	20%	15 hours	Presentation, Video presentation
Unit 4: Introduction to matrices, different types of matrices, Elementary operations on matrices and types of matrices, Symmetric and skew- symmetric matrices, Hermitian and skew – Hermitian matrices. Rank of a matrix. Row Reduced Echel on form of a matrix and matrix in version using it. Determinanet of 2 × 2 and 3 × 3 matrices. Inverse of a square matrix.	20%	15 hours	Presentation, Video presentation
Unit 5: Homogeneous and Non-homogeneous linear equations. Application of matrices in solving a system of simultaneous linear equations. Eigen values, Eigen vectors and the characteristic equation of a matrix. Cayley Hamilton theorem (without proof) and its use in finding inverse of a matrix.	20%	15 hours	Presentation, Video presentation

LEARNING RESOURCES

TEXTBOOKS	1. Shanti Narayan, Integral Calculus, S. Chand & Co. Ltd,1999. 2. Shanti Narayan, Differential Calculus, S. Chand & Co. Ltd,1999.
REFERENCE BOOKS	1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons Inc,1983. 2. G.B. Thomas Jr. and R.L. Finney, Calculus and Analytic Geometry, Addison- Wesley Publishers, 1999
Journals & Periodicals:	1. Indian Journal of Mathematics and Science 2. Indian journal of Mathematics and Statistics 3. Journal of Student understanding of basic calculus concepts
Other Electronic Resources:	MATLAB, Geogebra

Evaluation Scheme	**Total Marks 150 marks**

Mid semester Marks	30 marks	
End Semester Marks	70 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Assignment	30 MARKS
	Skill enhancement activities / case study	8 MARKS
	Presentation/ miscellaneous activities	7 MARKS
	The course involves a study of limits, continuity, derivatives and integrals.	
Course Outcomes	2. Computations of derivatives—sum, product, and quotient formulas, chain rule, implicit differentiation, applications of derivatives and related rate problems.	
	3. Definite integrals and fundamental theorem of calculus; application of definite integrals to computations of areas length, surface.	
	4. Study of systems of linear equations, matrices.	
	5. Determinants eigen values and eigen vectors, and their applications.	

Second Semester

BSCFS201	Communication Skills in English	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Hours in semester :30**		**Total Marks:100**		

1	**Course Pre-requisites:** Basic Knowledge of English Grammar & communication Basic English Grammar & Intermediate communication skills.
2	**Course Category: Ability Enhancement Compulsory Course**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

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 enable learners of develop their basic communication skills in English.
4	To make the students more confident day to day life.
5	To help them get good marks in computational exams.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: **Communicative Skills: Basics** of Communication, Verbal & Non-verbal Communication, Barriers to Effective Communication, Strategies of Effective Communication	20%	6 hours	Discussion, Language Lab/Software based learning, Practice
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 terms	20%	5 hours	Discussion, PowerPoint Presentation, Sample Practice & Revision

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%	6 hours	Discussion, Powerpoint Presentation, Language Lab/ Software based learning, Practice / Role Play
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%	7 hours	Discussion, Powerpoint Presentation, Practice / Role Play, Videos, Analysis of the videos
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%	6 hours	Discussion, Powerpoint Presentation, Language Lab/ Software based learning, Video, Practice / Role Play

LEARNING RESOURCES

TEXTBOOKS	1. Murphy, Raymond "Murphy's English Grammar with CD" Cambridge University Press, 2004. 2. Thorpe, Edgar and Showick Thorpe "Basic Vocabulary" Pearson Education India, 2012. 3. Green, David. "Contemporary English Grammar Structures and Composition" MacMillan Publishers, New Delhi, 2010.
REFERENCE BOOKS	1. Thorpe, Edgar and Showick Thorpe "Basic Vocabulary" Pearson Education India, 2012. 2. Green, David. "Contemporary English Grammar Structures and Composition" MacMillan Publishers, New Delhi, 2010. 3. Wren &Martin (2001), English Grammar & Composition, New York. 4. Mudambadithaya G.S., (2002) English Grammar and composition. 5. Lupton, Mary Jane (1998). Maya Angelou: A Critical Companion. Westport: Greenwood Press. ISBN 978-0-313-303225. 6. Booher, Diana. (2004), Booher's Rules of Business Grammar, OUPUr, Penny, (2002), Grammar Practice Activities, OUP.
Journals & Periodicals:	1. The Journal' Basic English Grammar 2. Fluent U' English Language and Cultural Journal 3. The Journal of English Academics' 4. Elsevier' The research on language

<table>
<tr><td></td><td colspan="2">1. Index Noedicus : A Cumulative Index to English Language Periodicals
2. The Illustrated English Language Periodicals</td></tr>
<tr><td>Other Electronic Resources:</td><td colspan="2">Google classroom, Google form Wordsworth - Language software, Jam board.</td></tr>
<tr><td colspan="2">Evaluation Scheme</td><td>Total Marks 100 marks</td></tr>
<tr><td>Mid semester Marks</td><td colspan="2">20 marks</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">70 marks</td></tr>
<tr><td rowspan="4">Continuous Evaluation Marks (20 Marks)</td><td>CATEGORY</td><td>MARKS</td></tr>
<tr><td>Attendance</td><td>5 MARKS</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Presentation/ miscellaneous activities</td><td>5 MARKS</td></tr>
<tr><td rowspan="5">Course Outcomes</td><td colspan="2">• Listen/view and comprehend different spoken discourses/excerpts in different accents.</td></tr>
<tr><td colspan="2">• Speak clearly, confidently and comprehensibly</td></tr>
<tr><td colspan="2">• communicate with one or many listeners using appropriate communicative strategies.</td></tr>
<tr><td colspan="2">• Enable students to be confident reader.</td></tr>
<tr><td colspan="2">• Enable students to speak the language in day-to-day life.</td></tr>
</table>

BSCFS205	Physical Training & Drills - 2	L	T	P	C
		0	0	2	2
Total Credits:2	**Total Hours in semester :60 hrs**		**Total Marks:50**		

1	**Course Pre-requisites: drills – 1**
2	**Course Category: skill enhancement compulsory courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To understand hose drills
2	To learn knots & lines
3	To learn fixed installations
4	To learn four man hydrant drill,
5	To understand ladder drill

Course Content	Weightage	Contact hours	Pedagogy
1) Hose Drill (Theory & Practical): - Hose binding, hose puncture, hose washing, hose storage, care and maintenance, hose roll, coil roll, ducth roll, flaking and figure of eight. **2) Knots & Lines (Theory and Practical)** **3) Three-man Hydrant Drill with Fixed Installations (Theory & Practical)** a) Dividing Breaching b) Collecting Breaching	100%	30 Hrs	Practice at Training Ground followed by class room lectures, Videos,

c) Add One Length of Hose **4) Four Man Hydrant Drill with Tactical Exercise (Theory & Practical)** a) Dividing Breaching b) Collecting Breaching c) Add One length of Hose **5) Ladder Drill**			

LEARNING RESOURCES

TEXTBOOKS	• Fire Service Manuals U.K.; • NFPA U.S.A; • Fire Drill Manual by NFSC Scaling, Type of Equipment and Training of Fire Services – National Disaster Management Guidelines

Evaluation Scheme	**Total Marks 50 marks**
Internal Marks	20 marks
External Marks	30 marks

BSCFS202	CHEMISTRY OF COMBUSTION	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Hours in semester :45hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** basic science
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Understand concepts and fundamentals of chemistry related to combustion process.
2	To provide knowledge of important terms, concepts and processes associated with combustion and ignition
3	To make students aware of special combustion processes associated with certain fuels and situations.
4	To become familiar with different fuel properties used to characterize the combustion hazard
5	Make students aware of significant chemical groups and their properties which influence their behavior with respect to combustion.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Basic chemical concepts related to atoms & molecules, compounds & mixtures, radicals, atomic & molecular mass, valency, nomenclature, simple & complex equations, stoichiometric equations, use and limitations of chemical equations, reaction conditions, heat and rate of reaction.	20%	9 hours	Discussion, Powerpoint Presentation, Practice / Role Play, Videos, Analysis of the videos

Unit 2: Fundamentals of combustion, concept of fire triangle and fire tetrahedron (role of active radicals), heat of reaction and calorific values of fuels, oxidation reactions, laminar and turbulent flow, premixed and diffusion flames, combustion in gases, liquids, solids, concept of flashpoint, fire point, ignition temperature, Phenomena related to compartment fires – flashover, blowback. Explosive burning, vapour cloud explosions.	20%	9 hours	Discussion, Powerpoint Presentation, Practice / Role Play, Videos, Analysis of the videos
Unit 3: Behaviour of different solids during combustion – wood, coal, sulphur, phosphorus, metals, polymers, dusts, monomers, intermediates, hardeners. Special combustion phenomena involving solids - smouldering fires, spontaneous heating and combustion	20%	9 hours	Discussion, Powerpoint Presentation, Practice / Role Play, Videos, Analysis of the videos
Unit 4: Properties and characteristics of different oxidizing agents- Nitric acid and inorganic nitrates, permanganates, chlorates, chromates and dichromates, inorganic peroxides, organic oxidizing agents, organic peroxides and hydroperoxides	20%	9 hours	Discussion, Powerpoint Presentation, Practice / Role Play, Videos, Analysis of the videos
Unit 5: Properties and characteristics of organic compounds - aliphatic hydrocarbons (paraffins or alkanes), unsaturated aliphatic hydrocarbons, olefines or alkenes, acetylenes, or alkynes, aromatic hydrocarbons, liquefied petroleum gases (LPG), simple oxygen-containing compounds derived from hydrocarbons, alcohols, aldehydes, ketones, carboxylic acids, esters & ethers	20%	9 hours	Discussion, Powerpoint Presentation, Practice / Role Play, Videos, Analysis of the videos

LEARNING RESOURCES

TEXTBOOKS	1. Fire Service Manual Volume 1, Physics & Chemistry for Firefighters, HMSO Publications 2. Cote, Arthur, Section 2 & 6, Fire protection Handbook, 20th Edition, NFPA 3. Purandare D.D. Handbook on Industrial Fire Safety, P&A Publications 4. Wharry, Hirst, Fire Technology - Chemistry & Combustion, IFE
REFERENCE BOOKS	1. Drysdale D, An Introduction to Fire Dynamics, 3rd Edition, John Wiley & Sons

Journals & Periodicals:	**NIL**	
Other Electronic Resources:	**NIL**	
Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	20 marks	
End Semester Marks	70 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	• Students will become familiar with common chemical terms, concepts and processes associated with combustion chemistry.	
	• . Students will become aware of different chemical groups and their significant characteristics which influence their combustion properties and behavior.	
	• Students will understand special combustion phenomena associated with certain fuels and be able to explain them in scientific terms.	
	• Students will become familiar with different properties and terms used to characterize the fire hazards of different chemicals.	
	• Students will be able to explain combustion process in chemical terms, and describe the various terms and terminology associated with ignition and combustion	

BSCFS203	Rescue Techniques & First Aid	L	T	P	C
		2	0	2	4
Total Credits:4	**Total Hours in semester :30hrs +60hrs**		**Total Marks:150**		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives:**	

1	To provide fundamental understanding of different rescue actions required and techniques adopted in ordinary and extraordinary accidents, including disasters.
2	To understand function and working of different respiratory and non-respiratory Personal Protective Equipment and specialized rescue equipment used by rescuers in emergencies
3	To learn about the human body & its various systems
4	To learn about the paramedic science related to handling of human casualty and diagnosis.
5	Gain theoretical and practical knowledge related to first aid treatment for burn, shock and other types of serious injuries

Course Content	Weightage	Contact hours	Pedagogy
Unit 1 The purpose and understanding of different rescue actions used in emergencies. Fundamental actions and techniques applied for rescue of victims in fire and other similar emergencies (Fires, Lift accidents, Car accidents, etc.). Understand rescue techniques applied for special hazards such as building collapse, trenches, sewers, machinery, etc. Recognize important allied functions required (such as trauma care, triage) in large scale emergencies/ disasters.	20%	6 hours	Presentation, Video presentation Chalk board Notes

Unit 2: Physiology of respiration, respiratory protective apparatus - Gas masks, Breathing Apparatus sets - types, constructional features, working principle and applications, calculation of the capacity & time duration of the B.A.set. Features of other important PPEs used during rescue operations. Overview of different electric, hydraulic, and pneumatically operated rescue tools and equipment commonly used in emergencies- Hydraulic Jack, Hydraulic Cutter, Hydraulic Expander, Air Lifting Bags, Electric Cutter, Electric Saw, Chain saw etc.	20%	6 hours	Presentation, Video, presentation, Chalkboard, Notes
Unit 3: Study of a Human Casualty: Including history taking, making of a diagnosis based on symptoms as narrated by the casualty and signs as observed by the paramedic. Checking temperature pulse, respiration, blood pressure, swellings, and discoloration of the skin, wounds, deformities etc. /to confirm the diagnosis. Casualties with affected vital functions, such as casualties in unconscious state, asphyxia, shock including their causes symptoms, signs and specific aspects of examination of such casualties and maintenance of records during their observation and care at the place incident and during transportations up to hospital. Study of	20%	6 hours	Presentation, Video presentation
specific injuries to body parts controlling their functions with external and internal injuries of head chest and abdomen including causes and consequences of external and internal bleeding.			
Unit 4: First aid/paramedic care of various types of Casualties and their injuries such as wounds, burns, injuries of bones and joints, disturbances in vital function including cardiopulmonary resuscitation, artificial respiration by manual and instrumental methods, bandages, splints, correction of shock, arrest of bleeding, treatment of hyperpyrexia, use of anti/shock fluids and their administration, Observation and maintenance of such causalities. Casualty handling including observation, maintenance of observation charts, treatment administered, temperature-pulse-respiration records, application of suction, appropriate positioning of casualties affected by head injuries, chest injuries, abdominal injuries, bleeding, shock, asphyxia et	20%	6 hours	Presentation, Video presentation Chalk board Notes
Unit 5: Basics of Paramedic Care & First Aid, including Practicals	20%	6 hours	Presentation, Video presentation, Chalk board Notes
LEARNING RESOURCES			

TEXTBOOKS	1. Fire Service Manual Volume 2 Incidents Involving Rescue from Road Vehicles, HMSO Publications 2. Practical Firemanship II, Manual of Firemanship, HMSO Publications 3. Manual of Firemanship, Book 5, Ladders & Appliances, HMSO Publications 4. Elementary principles of rescue by Govt. Of India, Ministry of Home Affairs 5. Product Data sheets & Operation/Maintenance Manuals for Rescue Equipments 6. L.G Gupta & Abhitabh Gupta, First Aid, Jaypee Brothers. 7. Cantlie, James, First Aid to injured, 8. St John Ambulance Association First Aid Manual by Indian Red Cross Society.
REFERENCE BOOKS	1. Rescue –Civil Defense Handbook by HMSO 2. Relevant ISI standards - Special appliances and equipments
Journals & Periodicals:	NIL
Other Electronic Resources:	NIL

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	20 marks
End Semester Marks	70 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Students will be able to demonstrate respiratory and non-respiratory first aid to human causality
	Students will develop familiarity with standard equipment used by Emergency responders such as B.A. Sets, ladders and PPEs, and specialized rescue equipment such as pneumatic, hydraulic and electric rescue tools.
	• Students will be able to evaluate various parameter concerning to human causality during emergency
	• Students will able to demonstrate understanding of different rescue techniques and actions required during emergencies, and specific actions required for special/ unusual situations

BSCFS204	MANUAL & PORTABLE FIREFIGHTING EQUIPMENT	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Lecture Hours in semester :45 hrs + 60hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives:**	
1	To provide fundamental understanding of different firefighting actions and techniques employed for fire incidents.
2	To understand function and working of different manual and portable firefighting equipment, including extinguishers, hose reels, hoses and different water and foam branches and fittings
3	Introduction to related codes and standards and the operational requirements and specifications of portable and mobile firefighting equipment.
4	Be able to operate manual and portable firefighting equipment and carry out testing and maintenance of the same

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Understanding the combustion process and how different extinguishing methods are employed depending on type of fuel involved, the characteristics and properties of different extinguishing agents, their suitability for different fuels and fire situations, and other factors. Classification of fires for portable extinguishers.	20%	15 hours	Chalk board Notes

Unit 2: Different types of fire extinguishers, their construction, design requirements, and operating mechanisms. Importance of operating techniques for different types of fires and different scenarios. Familiarization with related codes and standards e.g., IS:2190, IS:15683, IS:2878, NFPA 10			

Unit 3: Use of different branches in firefighting i.e., hose reel nozzle, short branch, basic spray nozzle, selectable flow nozzle, revolving nozzle, piercing nozzle, etc., in firefighting and their operational features. Different types of hoses being used in firefighting and their performance and testing requirements. Standards related to Firefighting branches and hoses (IS:884, IS:904, IS:906, IS:2871, IS:8423, IS:636, etc.).			Chalk board Notes
Unit 4: Understand use and application of portable foam equipment commonly used by the Fire Service i.e., foam branches of different types, foam generators, portable foam inductors, etc. Become familiar with Indian/international standards and industry specific specifications for these equipment (IS:2097, NFPA 11, NFPA 11, etc.			Chalk board Notes
Unit 5: Appreciate the importance of proper ITM practices for effective operation of manual and portable firefighting equipment. Become familiar with ITM requirements as stated in standards and OEM manuals, and be able to interpret and execute the same in a practical and safe manner.			Chalk board Notes

<table>
<tr><th colspan="4">LEARNING RESOURCES</th></tr>
<tr><td>TEXTBOOKS</td><td colspan="3">• Fire Service Manual Volume 1, Inspection & Testing of Equipment, HMSO Publications
• Fire Service Manual Volume 1, Firefighting Foam-Technical, HMSO Publications
• Manual of Firemanship, Book 2 –Fire Brigade Equipment, HMSO Publications
• Purandare D.D. Handbook on Industrial Fire Safety, P&A Publications
• Various IS & International Standards (IS:884, IS:904, IS:906, IS:2871, IS:8423, IS:636, IS:2097, NFPA 10/ 11, OISD 117/118</td></tr>
<tr><td>REFERENCE BOOKS</td><td colspan="3">1. Rescue –Civil Defense Handbook by HMSO
2. Relevant ISI standards - Special appliances and equipments</td></tr>
<tr><td>Journals & Periodicals:</td><td colspan="3">NIL</td></tr>
<tr><td>Other Electronic Resources:</td><td colspan="3">NIL</td></tr>
<tr><td colspan="2">Evaluation Scheme</td><td colspan="2">Total Marks 100 marks</td></tr>
<tr><td colspan="2">Mid semester Marks</td><td colspan="2">20 marks</td></tr>
<tr><td colspan="2">End Semester Marks</td><td colspan="2">70 marks</td></tr>
<tr><td rowspan="2">Continuous Evaluation</td><td>CATEGORY</td><td colspan="2">MARKS</td></tr>
<tr><td>Attendance</td><td colspan="2">5 MARKS</td></tr>
</table>

Marks (10 Marks)	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will be explained different extinguishing actions in a logical and scientific manner, and demonstrate understanding of suitability of different fire extinguishing agents based on type of fuel involved.	
	2. Students will understand the techniques involved in operation of different portable and manual firefighting equipment, and understand their suitability and application for different fire situations.	
	3. Students will develop familiarity with standards and codes of the various portable and manual firefighting equipment, and understand the technical requirements stated in these documents.	
	4. Students will become familiar with the practical operation of different equipment and associated techniques.	
	5. Students will appreciate the importance of proper ITM practices for each equipment, and be able to identify ITM requirements using codes and OEM manuals.	

BSCFS26P	PHYSICS - II	L	T	P	C
		4	0	0	4
Total Credits:4	**Total Hours in semester :60 hrs+30hrs**		**Total Marks:150**		
1	**Course Pre-requisites:** physics-1				
2	**Course Category: Generic Elective**				
3	**Course Revision/ Approval Date:**				
4. **Course Objectives:**					

1	Primary aim of this subject is to acquaint the students with some of the topics in Physics which are of fundamental importance to resolve issues faced by scientists and engineers
2	The course also serves as a prerequisite to the advanced courses in Modern Physics, Experimentation, Pre-requisites
3	Topics of the course are supported by practicals that reveal fundamentals behind the laws discussed in classes, which strengthens students' understanding of the subject.
4	To recognize the relationship between the conceptual description of nature and its mathematical expression.
5	To understand the relationship between observation and theory and their use in building the basic concepts of modern physics.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: **Atoms and Nuclei** Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, Radioactivity, alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear fusion.	20%	24 hours	Powerpoint Presentation, Classroom Discussions, Virtual Labs

Unit 2: **Dual nature of radiation** Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation; particle nature of light. Matter waves - wave nature of particles, de Broglie relation. Davisson-Germer experiment.	20%	24	Powerpoint Presentation, Classroom Discussions, Virtual Labs
Unit 3: Ray Optics Reflection of light, spherical mirrors, mirror formula, refraction of light, total internal reflection and its applications, refraction at spherical surfaces, lenses, thin lens formula, lensmaker's formula, magnification, power of a lens, combination of thin lenses in contact, refraction of light through a prism. Scattering of light - blue colour of sky and reddish appearance of the sun at sunrise and sunset.	20%	24	Powerpoint Presentation, Classroom Discussions, Virtual Labs
Unit 4: Temperature dependence of resistance. Electric Cell and its Internal resistance, potential difference and emf of a cell, a combination of cells in series and in parallel. Kirchhof's laws and their applications. Wheatstone bridge, Metre bridge. Potentiometer – principle and its applications. Semiconductors; semiconductor diode: I-V characteristics in forward and reverse bias; diode as a rectifier; I-V characteristics of LED, photodiode, solar cell and Zener diode; Zener diode as a voltage regulator.	20%	24	Powerpoint Presentation, Classroom Discussions, Virtual Labs
Unit 5: **Sound** Simple harmonic motion - vibrations and resonance - Fourier's Theorem - Application to sawtooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.	20%	24	Powerpoint Presentation, Classroom Discussions, Virtual Labs
LEARNING RESOURCES			

TEXTBOOKS	1. Essentials of Physical Chemistry, A. Bahl, B.S. Bahl, G.D. Tuli, 28/e, 2020, S. Chand Publishing. 2. Practical physics electricity, magnetism, electronics and optics, A. Srivastava, R.K. Shukla, 2/e, 2018, New Age International. 3. Principles of Electronics, V.K. Mehta, 1980, S. Chand Publishing. 4. Fundamentals of Optics, F. A. Jenkins and H. E White, 1976, McGraw-Hill. 5. Textbook of Sound, N. Subrahmanyam, B. Lal, 2/e, 2018, Vikas Publishing House.
REFERENCE BOOKS	1. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley. 2. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Journals & Periodicals:	1. Journal of Undergraduate Reports in Physics (JURP) 2. Journal of Young Investigators (JYI) 3. Columbia Undergraduate Science Journal (CUSI) 1. Student Journal of Physics 2. Indian Journal of Physics
Other Electronic Resources:	Feynman Lectures in Physics: https://www.feynmanLectures.caltech.edu/

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	20 marks -	
End Semester Marks	70 marks	
Continuous Evaluation Marks (10 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1.Students will be able to grasp fundamentals related to subjects closely related to science and engineering streams.	
	2. Students will have a good understanding of solving practical problems related to fundamental Physics.	
	3. This course also prepares the student for other advanced courses in science and engineering	
	4.Students will be able to develop skills in observation, interpretation, reasoning, synthesis, generalizing, predicting, and questioning as a way to learn new knowledge.	
	1. This course also prepares the student for other advanced courses in science and engineering.	

BSCFS206M	Mathematics-II	L	T	P	C
		4	2	0	6
Total Credits:6	**Total Hours in semester :75+15**		**Total Marks:150**		

1	**Course Pre-requisites: maths-1**
2	**Course Category: Discipline Specific Generic Elective**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Demonstrate understanding of the meaning of an ordinary differential equation (ODE), its order, degree, its general solution, and its particular solution.
2	Recognize and solve different types of first-order ODEs, including separable, exact, homogeneous and linear and Bernoulli equations.
3	Solve simple applied initial value problems (IVPs) modelled with first-order ODEs, including population models, Newtonian mechanics problems, and heating and cooling problems.
4	Understand differentiation and integration of two or more variable by partial derivative.
5	Find maxima and minima of functions of two variables, Understand the optimization problems with functions of two variables.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: **Ordinary Differential Equations** Degree and order of a differential equation, Equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear equations and equations reducible to the linear form.	20%	15 hours	Lectures, Virtual Labs, Animations, Presentations, Quiz

Unit 2: Exact differential equations, Integrating factors. Applications of first order equations: Mixture problem, Orthogonal trajectories, Decay and Growth problems, Temperature problem	20%	15 hours	Lectures, Virtual Labs, Animations, Presentations, Quiz
Unit 3: Linear differential equations of higher order, Homogeneous equations, Differential operators, Method of solving homogeneous equations, Non-homogeneous equations, Inverse operators, Methods of solving non- homogeneous equations. Application Cardiography (ECG).	20%	15 hours	Lectures, Virtual Labs, Animations, Presentations, Quiz
Unit 4: Function of several variables, Limit and continuity of function of several variables, partial derivatives of function of two variables, Total differential, Chain rule, implicit differentiation, Euler's theorem for homogeneous function	20%	15 hours	Lectures, Virtual Labs, Animations, Presentations, Quiz
Unit 5: Applications of Partial Derivatives, Tangent plane, Normal line, Linear approximation, Maximum and minimum values by second derivative test, Lagrange's method of multipliers and Taylor's formula for two variables.	20%	15 hours	Lectures, Virtual Labs, Animations, Presentations, Quiz

LEARNING RESOURCES

TEXTBOOKS	1. Shanti Narayan, Integral Calculus, S. Chand & Co. Ltd,1999. 2. Shanti Narayan, Differential Calculus, S. Chand & Co. Ltd,1999.
REFERENCEBOOKS	1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons Inc,1983. 2. G.B. Thomas Jr. and R.L. Finney, Calculus and Analytic Geometry, Addison- Wesley Publishers, 1999
Journals & Periodicals:	1. Indian Journal of Mathematics and Science 2. Indian journal of Mathematics and Statistics 3. Journal of Student understanding of basic calculus concepts
Other ElectronicResources:	**NIL**

Evaluation Scheme	Total Marks 150 marks
Mid semester Marks	30 marks
End Semester Marks	70 marks

	CATEGORY	MARKS
Continuous EvaluationMarks (50 Marks)	Attendance	8 MARKS
	Assignment	30 MARKS
	Skill enhancement activities / case study	8 MARKS
	Presentation/ miscellaneous activities	7 MARKS

Course Outcomes	The course involves a study of ordinary differential equations
	A study of partial derivatives
	Applications of ordinary and partial differential equation
	Identify the corresponding type of equation or system of equations and to learn techniques for solving them.
	Application of partial derivatives

BSCF211P	PHYSICS II	L	T	P	C
		0	0	2	2
Total Credits:2	**Total Lecture Hours in semester : 60hrs**		**Total Marks:50(20+30)**		

1	**Course Pre-requisites:** Nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Primary aim of this subject is to acquaint the students with some of the topics in Physics which are of fundamental importance to resolve issues faced by scientists and engineers
2	The course also serves as a prerequisite to the advanced courses in Modern Physics, Experimentation, Pre-requisites
3	Topics of the course are supported by practicals that reveal fundamentals behind the laws discussed in classes, which strengthens students' understanding of the subject.
4	To recognize the relationship between the conceptual description of nature and its mathematical expression.
5	To understand the relationship between observation and theory and their use in building the basic concepts of modern physics.

List of Experiments:			

1. Study of Emission spectra of Hydrogen atom. 2. Study of Photoelectric effect and calculation of Planck's constant (i) To find the value of Planck's constant and photoelectric work function of the material of the cathode using a photo- electric cell. (i) To verify the inverse square law of radiation using a photo-voltaic cell 3. Determination of refractive index of a given liquid using optical parallax method. **4.** To find Temperature coefficient of resistance (TCR) of a given coil. 5. Introduction to CRO/DSO: (i)To understand the functions of CRO/DSO. (ii)Measure frequency of AC signal and AC & DC voltage. **6.** To study the I-V characteristics of solar cells / Zener diodes. 7. Ultrasonic Interferometer: To find the adiabatic compressibility of a given liquid using an ultrasonic interferometer. **8.** Ultrasound Imaging: B-mode Ultrasound Scanner for medical diagnostics.			

LEARNING RESOURCES

Evaluation Scheme	**Total Marks 100 marks**	
Journal	10 marks	
Practical Examination Marks	30 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Viva	5 MARKS

Third Semester

	Entrepreneurship Development	L	T	P	C
		2	0	0	2
Total Credits: 2	**Total Hours in semester :30**		**Total Marks:100**		

1	**Course Pre-requisites:** nil
2	**Course Category: Ability Enhancement Compulsory Course**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	Students will develop skills for evaluating, articulating, refining, and pitching a new product or service offering.
2	Identify the elements of success of entrepreneurial ventures.
3	Analyze Feasibility of the project (Financial and Non-Financial) and interpret business plan.
4	Demonstrate and present successful work, collaboration and division of tasks in a multidisciplinary and multicultural team.
5	Demonstrate understanding and application of the tools necessary to create sustainable and viable Businesses.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: **Introduction** Meaning, Needs and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.	20%	6 hours	Power point, Power point, Video, Chalk & Board, Students' seminar, Quiz Pre-requisites

Unit 2: **Establishing an enterprise** Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility.	20%	6 hours	Power point, Power point, Video, Chalk & Board, Students' seminar, Quiz Pre-requisites
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 hours	Power point, Power point, Video, Chalk & Board, Students' seminar, Quiz Pre-requisites
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 hours	Power point, Power point, Video, Chalk & Board, Students' seminar, Quiz Pre-requisites
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 hours	Power point, Power point, Video, Chalk & Board, Students' seminar, Quiz Pre-requisites

LEARNING RESOURCES

TEXTBOOKS	1. Holt DH. Entrepreneurship: New Venture Creation
REFERENCE BOOKS	1. Kaplan JM Patterns of Entrepreneurship. 2. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management, Sultan Chand & Sons.
Journals & Periodicals:	The Journal of Entrepreneurship Journal of Small Business and Entrepreneurship Development
Other Electronic Resources:	MIT Open Courseware, Code Academy, Khan Academy.

Evaluation Scheme	**Total Marks 100 marks**

Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	Explore and experience the joy of creating unique solutions to market opportunities. Create and exploit innovative business ideas and market opportunities	
	Turn market opportunities into a business plan	
	Build a mindset focusing on developing novel and unique approaches to market opportunities	
	Demonstrate and present successful work, collaboration and division of tasks in a multidisciplinary and multicultural team	
	Demonstrate understanding and application of the tools necessary to create sustainable and viable Businesses.	

	Physical Training & Drills - 3	L	T	P	C
		0	0	2	2
Total Credits: 2	**Total Hours in semester :60**		**Total Marks:50**		
1	**Course Pre-requisites:** Drills-2				
2	**Course Category: skill enhancement course**				
3	**Course Revision/ Approval Date:**				
4. **Course Objectives:**					
1	To learn about pump drill				
2	To learn about various types of foam drill				
3	To learn the water relay system				
4	To understand the water tenders				

Course Content	Weightage	Contact hours	Pedagogy
1) Pump Drill **Using Trailor pump (TP) & Portable Pumps (Theory & Practical)** a) Dividing b) Collecting c) Use 5-way Valve **2) Foam Drill (Theory & Practical)** a) FB-2(Knap Sack Tank) b) FB-10 (Inline Inductor)	100%	30 Hrs	Open Ground Exercise, Classroom lectures,

c) MFG and other latest Technology (High Expansion Foam Generator) d) Fixed foam installation system. **3) Water Relay (Theory & Practical)** a) Open Circuit b) Close Circuit c) Collecting Pumping **4) Water Tender and Appliance Drill (Theory & Practical)** a) Water Tender Drill with Hose real, Hose ladder 4 men, 5 men, & 6 men drill hydrant and open source b) Rescue with appliance Drill c) Foam tender drill d) TTL & hydraulic platform Drill e) Crash Tender drill f) Emergency Tender Drill			videos

LEARNING RESOURCES

TEXTBOOKS	• Fire Service Manuals U.K.; • NFPA U.S.A; • Fire Drill Manual by NFSC • Scaling, Type of Equipment and Training of Fire Services – National Disaster Management Guidelines
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 50 marks**
Internal Marks	25 marks
External Marks	25 marks

	Safety Engineering and its Industrial Applications	L	T	P	C
		3	0	0	3
Total Credits: 3	**Total Hours in semester: 45 hrs**		**Total Marks:100**		
1	**Course Pre-requisites:**				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:**				
4. **Course Objectives:**					
1	To introduce students to different aspects of safety engineering.				
2	To understand the theory and principles of accident causation, prevention and control measures in industries.				
3	To gain knowledge of fire and other hazards in different industries, and control measures applied for controlling the same.				
4	Appreciate safety management structure, role and responsibility in industrial scenarios				
5	Understand occupational and health hazards in industries and systems for addressing the same.				

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1: Theory and principles of accident causation, unsafe act and unsafe conditions, case studies, Accident- Investigation Procedure, Safety Committee organization & functions; Safety performance measurement; Safety policy, Safety in material handling.	20%	9 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Good housekeeping and safety, personal protective equipment needs & limitations, Hazards & risk assessment techniques, job safety analysis, fault tree analysis, ergonomic concept, local exhaust ventilation, plant inspection procedure, safe working in confined space, work permit system.	20%	9 hours	Presentation, Video presentation, Chalk board, Notes
Unit 3: Control of industrial noise, lighting, heat & ventilation, safety officer- role, responsibilities, power & duties, role of management, supervisor, trade- union, workers & Government, safety in use of hoists, lifts, & lifting machines, safety in pressure plants, principles of machine guarding, types & selection of machine guards.	20%	9 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Safety in industries involving hazardous processes, safety in industries involving highly flammable liquids & flammable compressed gases, safety in chemical works, application of safety in handling corrosive substances, safety audit in various types of factories, types of safety audit, its methodology and reporting.	20%	9 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Hazards & their control in the manufacture of articles from refractory materials, hazards in solvent extraction plants & their control, safety in industries, manufacturing rayon by viscose process, hazards & their control in fertilizer industries, hazards & control in LPG bottling plant.	20%	9 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	Spellman, Whiting, The Handbook of Safety Engineering, Principles and Applications Ganguly, Changeria, Safety Engineering, Chetan Publication, 2016 Deshmukh L.N., Industrial Safety Management, McGraw Hill, 2017 Handbook of Industrial Safety by K.U. Mistry, Siddarth Prakashan, Gujarat
REFERENCE BOOKS	Brauer R.L. Safety & Health for Engineers, 3rd edition, Wiley
Journals & Periodicals:	**NIL**

Other Electronic Resources:	**NIL**	
Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	• Students will become familiar with different aspects of safety engineering in industries.	
	• Students will be able to explain the principles of accident causation, prevention and control measures in industries.	
	• Students will understand fire and other significant hazards associated with different industries and the control measures applied.	
	• Students will be able to describe occupational hazards associated with the industries and common practices to address them	
	• Students will become aware of safety management structure normally practiced in industries, as well as their roles/responsibilities	

	Town Planning & Safety in Construction Industry	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester :45 hrs +30 hrs**		**Total Marks:150**		

1	**Course Pre-requisites:** nil
2	**Course Category: other Discipline Core Courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	Understand key concepts of town planning and factors/hazards taken into consideration.
2	To become familiar with the different stages of building design & construction and associated permits (statutory permits/ practices, agencies involved) and control procedures/systems.
3	To understand the hazards associated with specific activities associated with building construction and control procedures and safety practices currently employed.
4	Appreciate the hazards involved in working at height, and become familiar with correct procedures, PPE and tools and tackles required for such rescue operations involving building construction sites.
5	To become aware of occupational health and welfare aspects associated building aspects and systems for control & monitoring.

Course Content	**Weightage**	**Contact hours**	**Pedagogy**

Unit 1: Town Planning: Planning surveys, selection of site for urban development, consideration of climate, topography, drainage and water supply etc. Types of roads in urban areas, communication system and it relationship to the cities. Different type of buildings, layout of different areas with consideration of site orientation, views and architectural aesthetics. Hazard, Risk and Vulnerability analysis in town planning, Risk informed town planning. **Practical 1** 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%	8 hours +6 hours	Presentation, Video presentation, Chalk board, Notes
Unit 3: Understand the basic building design and construction process and the stages involved i.e., design, engineering, construction, commissioning and testing and handover. Building permit system, types of permits– initial, building occupation, testing and commissioning requirements and agencies involved. Accident investigation and reporting. Monitoring of safety performance. Treatment of injuries and rehabilitation. Safety Budget, organization, training, implementation. Safety officers. Safety committee **Practical 2:** Residential Planning: Two storied Building: Plans, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening. Scale-1:100**.**	20%	8 hours +6 hours	Presentation, Video presentation, Chalk board, Notes
Unit 3: Basic Philosophy of structural Soundness, accident and hazards – their causes & effect. 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, Frame work, Ladders, Concreting wall and floor openings, staircases and railings. Structural steel work including welding, cutting erection etc. Safety in use of related machinery equipments. Safety measures with respect to building materials including comment, lime, timber, steel, glass, paints, varnishes, and petroleum product **Practical 3:** Public Building school plan: Ground Floor plan, typical floor plan, elevation,section, lay-out plan, key plan, site plan, area table, schedule of opening.	20%	12 hours +6 hours	Presentation, Video presentation Chalk board

Unit: -4: Key Hazards and risks associated with working and rescue at height - nature of work, work site and environmental conditions. Safe systems of work – before, during and after work at height. Protective and rescue equipment used – webbing slings, lanyards, safety and work harnesses, ropes, categories of rope and rope control devices. **Practical 4:** 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%	8hours + 6hours	Presentation, Video presentation Chalk board Notes
Unit 5: Occupational health and safety of workers at construction sites - Occupational hazards & diseases. Personal protective equipment. Health & welfare measures. First aid facilities. Occupational health centers. Ambulance rooms. Medical examination. Salient Features of safety and Health in The Building & other Construction Workers (Regulation of employment and conditions of service) Act 1996 and central rules 1998 IS & NB codes). **Practical 5:** Working Drawing: sheet should accommodate min. six types with sectional details. (Furniture plan, Drainage lay out, Toilet Detail, Wood work detail, Kitchen detail, Electrical plan etc.). Perspective Drawing: Two-point perspective of sheet -1 planning. (B) Assignments: (1) Assignment -1: Principles of Planning & Architecture (2) Assignment -2: Building Bye laws (3) Assignment -3: Town Planning**.**	20%	5 hours +6 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	1. Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979. 2. OSHA Construction Safety Handbook, 6th Edition, J. J. Keller & Associates 3. Fire Service Manual Volume 2, Safe Work at Height, HMSO Publications 4. The building and other construction workers (Regulation of Employment & conditions of service) Act 1996 and central rules 1998. 5. P.S. Rangwala, Town Planning, Charotar Publishing Housing Pvt. Ltd., 2008

REFERENCE BOOKS	Accident prevention manual for Industrial operations, NSC, Chicago, 1982.	
Journals & Periodicals:	**NIL**	
Other Electronic Resources:	**NIL**	
Evaluation Scheme	**Total Marks 150 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1 Students will understand important concepts related to town planning, and main factors and hazards considered.	
	2. Students will be able to describe the different stages of building design & construction, and the regulatory process involved with different stages of the building process	
	3. Students will understand the hazards associated with building construction activities and be able to describe important control procedures and safety practices	
	4.Students will be recognizing the hazards of working at height, and understand rescue procedures, tools, equipment and PPE required for such operations	
	5 Students will appreciate the occupational health and safety concerns of workers at construction sites, and	

	understand procedures for control and monitoring.

	Safety in Oil & Gas Industry	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Total Credits: 3	**Total Hours in semester :45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:**
2	**Course Category: other Discipline Core Courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	To become familiar with Oil & Gas operations and activities at upstream, midstream and downstream stage.
2	To understand characteristics of crude oil and the classification of petroleum products.
3	To learn about the refining and associated process, related hazards and control measures applied.
4	To appreciate the importance of emergency planning related to firefighting operations in Oil & Gas units/processes
5	To become aware of statutory requirements pertaining to refineries, petrochemical pants and gas terminals.

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1: Overview of the oil & gas industry and operations, activities and processes associated with upstream, midstream and downstream sectors. Crude oil - formation, properties & characteristics, vapour formation, flammability, flash point, self-ignition temperature, Classification of crude oil & its derivatives, MSDS of crude oil, diesel, gasoline, kerosene, LPG, Natural Gas, Naphtha, etc.	20%	9 hours	Presentation, Video presentation

Unit 2: Refining Processes: - Primary Distillation, catalytic cracking, polymerization, reforming, steam cracking, sulphur recovery, lubricating oil treating, calcined coke, steam cracking, Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types	15%	6 hours	Presentation, Video presentation, Chalk board
Unit 3: Layout of Refineries, simplified flow diagram of a typical refinery, different units and facilities required in a typical refinery – marine terminals and jetties, raw material (crude) and finished products storage tank farms, bunds, different process units, distribution areas and pipelines, product dispatch arrangements – pipeline transfer, road and rail transport, etc. Control measures applied in design, layout and operation of refineries and petrochemical plants	25%	12 hours	Presentation, Video presentation
Unit: -4 Understand Fire protection & emergency planning - potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks. Firefighting facilities for depots, terminals, onshore, off-shore drilling platforms, and pipelines for transportation of petroleum products & Gas. Major fire risks, design criteria for selection of fire water network, firefighting installations such as hydrant, mobile water monitors, foam pourer, DCP fixed, subsurface injection & clean agent systems. Storage tanks protection – different systems currently being applied. Use of various media in petroleum & gas fires such as water, foam, DCP.	15%	6 hours +8 hours	Presentation, Video presentation Chalk board Notes
Unit 5: Statutory provisions pertaining to refineries, petrochemical plants & gas terminals – setup and role of organizations such as Oil Industry Safety Directorate (OISD) & Petroleum & Natural Gas Regulatory Board (PNGRB). Look at important OISD standards with respect to safety and fire protection such as OISD-116, 117,118. Overview of new and advanced technologies being applied for safety.	25%	12 hours +4 hours	Presentation, Video presentation Chalk board Notes

LEARNING RESOURCES

TEXTBOOKS	• Dalvi, S., Fundamentals of Oil & Gas Industry for Beginners, Notion Press • Fire Service Manual, Volume 2, Fire Service Operations, Petrochemical Incidents, HMSO Publications • OISD Standards (116 - Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants,

	117 - Fire Protection Facilities for Petroleum Depots, Terminals, Pipeline Installations & Lube oil installations, 118 - Layouts for Oil and Gas Installation • Petroleum & Natural Gas Regulatory Board (PNGRB) regulations
REFERENCE BOOKS	Loss prevention in Process of Industries, Vol 1,2, & 3, Frank P. Lees
COURSE OUTCOMES	1. Students will become familiar with Oil & Gas operations and activities at upstream, midstream and downstream stage. 2. Students will be able to describe characteristics of crude oil and the classification of petroleum products. 3. Students will understand crude refining and associated processes, their related hazards and control measures applied. 4. Students will understand the importance of emergency planning related to firefighting operations in Oil & Gas units/processes. 5. Students will become aware of statutory requirements pertaining to refineries, petrochemical pants and gas terminals.

Fourth Semester

	Environmental Science	L	T	P	C
		4	0	0	4
Total Credits: 4	Total Hours in semester :30 hrs		Total Marks:100		

1	**Course Pre-requisites: Nil**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

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	Develop skills and a commitment to act independently and collectively to environment sustainability.
4	Students can able to debate environmental science with use of appropriate scientific information.
5	Engaging with students of all disciplines to think critically, ethically, and creatively when evaluating environmental issues.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: **Introduction of Ecology** Ecology-Objectives and Classification Concepts of an ecosystem-structure & function of ecosystem components of ecosystem, Hydrological cycle, carbon cycle, oxygen cycle, Nitrogen cycle, Sulphur cycle.	20%	6 hours	Presentation, Video presentation Chalk board Notes

Unit 2: **Ecological pyramids of various ecosystems** Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic ecosystem, Estuarine Ecosystem.	20%	6 hours	Presentation, Video presentation, Chalk board, Notes
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	Presentation, Video presentation, Chalk board, Notes
Unit 4: **Water pollution and its control** Introduction, Classification of water pollutants, physical, chemical and biological characteristics of waste water, waste water 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	Presentation, Video presentation, Chalk board, Notes
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	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	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. Bharuch, 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
REFERENCE BOOKS	1. Environmental Pollutants and Bioavailability 2. Clean Air Journal 3. Emerging Contaminants 4. Environment: Science and Policy for Sustainable Development 5. Annual Review of Environment and Resources 6. Renewable Energy 7. Renewable & Sustainable Energy Reviews 8. Environmental Health 9. Environment International 10. International Journal of Environmental Research and Public Health
Journals & Periodicals:	1. Environmental Pollutants and Bioavailability 2. Clean Air Journal 3. Emerging Contaminants 4. Environment: Science and Policy for Sustainable Development 5. Annual Review of Environment and Resources 6. Renewable Energy 7. Renewable & Sustainable Energy Reviews 8. Environmental Health 9. Environment International 10. International Journal of Environmental Research and Public Health 1. The Environmental Magazine 2. Natural History (magazine) 3. Environment News Service 4. The Environmentalist 5. Green Builder Media
Other Electronic Resources:	1. Green.tv—supported by UNEP—broadband TV channel for films about environmental issues 2. Climate Change TV—funded by companies, governments and organisations, and produced by the magazine Responding to Climate Change—the world's first web channel specific to climate change videos

	3. Terra: The Nature of Our World video podcast produced in conjunction with the Master of Fine Arts program in Science & Natural History Filmmaking at Montana State University, Filmmakers for Conservation, and PBS—weekly video show about science and natural history 4. Green Times Ahead—based in India—student run non-profit with a focus on evading the detrimental effects of air and water pollution, constantly involved in communal engagement 5. IUCN Red data List 6. Air quality index 7. Nature Education Knowledge Project

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	20 marks
End Semester Marks	70 marks

Continuous Evaluation Marks (10 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	
	Skills for identifying environmental problems: Evaluate information from popular electronic and print media
	Interdisciplinary - When encountering environmental problems students will assess necessary scientific concepts and data, consider likely social dynamics, and establish integral cultural contexts
	Communication - Students will communicate with precision, effective art, and sound rhetoric in writing, in speech, and in digital media.
	Research - When faced with questions that lie beyond their current knowledge base, students will actively research data, concepts, histories, and narratives necessary for adequate consideration of the issue.
	Intellectual Flexibility - Students will possess the intellectual flexibility necessary to view environmental questions from multiple perspectives, prepared to alter their understanding as they learn new ways of understanding.

	Physical Training & Drills - 4	L	T	P	C
		0	0	2	2
Total Credits: 2	Total Hours in semester: 60 hrs		Total Marks:50		

1	**Course Pre-requisites: Physical Training & Drills – 3**
2	**Course Category:**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To understand the importance of breathing apparatus & its construction
2	To understand the limitations of breathing apparatus & its use in different emergency scenarios.
3	To know about different rescue techniques to save lives, properties & environment
4	To understand the types of first aid equipment & their uses
5	To understand the various method of first aid treatment to be given to injured, transporting injured person, artificial respiration, CPR.

Course Content	Weightage	Contact hours	Pedagogy
1) Breathing Apparatus Set Drill a) Smoke Logged area b) Confined Place c) Collapsed structure d) Rescue Techniques **2) Rescue Drill** a) Rescue Drill in confined place b) Rescue Techniques with live causality c) Crash car rescue & Motor Vehicle Fire Fighting **3) First Aid & Ambulance Drill** a) Stretcher Drill b) CPR (Cardiopulmonary resuscitation)			

c) First Aid methods to casualties			

LEARNING RESOURCES	
TEXTBOOKS	1. Fire Service Manuals U.K. 2. NFPA U.S.A. 3. Drill manual India

Evaluation Scheme	**Total Marks 50 marks**
Internal Marks	25 marks
External Marks	25 marks

	Automobile Technology & Different Fire Tenders	**L**	**T**	**P**	**C**
		3	0	**2**	**4**
Total Credits: 4	**Total Hours in semester :45hrs + 15 hrs**		**Total Marks:150**		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	To be able to identify different important components of automobiles such as IC engines, differential system, electrical system, and describe their purpose.
2	To become familiar with different types of IC engines, differential systems, suspension systems, electrical systems; their application and operational characteristics
3	To understand different legal requirements for vehicles as per Indian Motor Vehicle Act, including safety systems and devices.
4	To describe different types of Fire Tenders currently being used in the Fire Service; their application and operational requirements
5	To get introduced to Indian standards for different Fire Tenders, and their requirements and specifications.

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1: Important components of Automobiles, their function and basic description: Engines, Fuel injection systems, Clutch, Transmission assembly, gear boxes, differential, suspension system, axles, brakes, steering systems. their classification, construction, components.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Combustion in IC Engines, Study of fuel system components. Function of carburettors, construction details, Study of diesel fuel feed systems. Carburetion and mass distribution of mixture, supercharging, fuel injection and injection sections. Clutch, Types, Construction, Operation and Fault finding of clutches. Transmission assembly, Types of Gear box, Differential Necessity, Construction of differential systems. Axles, Types and Application.	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**:** Brakes, Types, Construction and Operation of Hydraulic, Pneumatic Brake Systems, Maintenance of Brakes. Suspension, Necessity, Types, Construction and operation, Shock absorber, Coil springs, independent suspension, Hotchkiss drive, Torque tube drive. Steering, Systems, Constructional details, types of steering gear box, steering geometry, caster, camber, king pin inclination, Effect of steering geometry on directional stability, Power steering Lubrication systems. Types, classification of systems. Lubricants. Cooling System – Air cooling, components, and working of cooling systems	20%	14 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Understand the importance of safety in design and construction of vehicles and main provisions in the Indian Motor Vehicle Act related to safety aspects	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 5: Standards related to Fire-fighting vehicles and appliances viz Trailer pump, Water Tender, Foam Tender, Emergency Tender, DCP Tender (IS:944, IS:950, IS:10460, IS:949, IS;10993, IS:951). Important code provisions related to operational requirements and accessories for Fire-fighting vehicles in these documents.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes
LEARNING RESOURCES			

TEXTBOOKS	1. Wills H. Crouse, Automobile chassis and body construction, Operation and Maintenance, Tata McGraw Hill 1976 2. Dr. D.S. Kumar, Automobile Engineering, S.K. Kataria & Sons 2015 3. S. Adhey, Bormh Practical Automobile Engineering Illustrated, Asia Publishing House, 1983 4. G.B.S. Narrang, Automobile Engineering, Khanna Publisher 5. Various BIS standards - IS:944, IS:950, IS:10460, IS:949, IS;10993, IS:951
REFERENCE BOOKS	R.B. Gupta, Automobile Engineering, Satya Prakashan 2015 R.P. Sharma, A Course in Automobile Engineering, Dhanpat Rai & Sons
Journals & Periodicals	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	20 marks	
End Semester Marks	70 marks	
	CATEGORY	**MARKS**
	Attendance	5 MARKS
Continuous Evaluation Marks (10 Marks)	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Students will be able to identify and describe the function of different important components of automobiles.
	Students will become familiar with the working mechanism and operational features of different important components of automobiles such as engines, differential systems, suspension, braking and electrical systems.
	Students will get exposed to important legislation such as the Indian Motor vehicle act and be able to describe important requirements related to safety aspects in design and construction of vehicles
	Students will be able to describe different Fire Tenders used for various firefighting, rescue and associated applications.
	Students will get exposed to IS codes related to different Fire fighting vehicles and tenders, and identify important operational features and functional requirements for such vehicles

	Fire Protection Systems – Design & Application	**L**	**T**	**P**	**C**
		4	**0**	**2**	**6**
Total Credits: 6	**Total Hours in semester :45 hrs**		**Total Marks:150**		
1	**Course Pre-requisites:**				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:**				
4. **Course Objectives:**					
1	To introduce students to the need, suitability and effectiveness of commonly installed water-based fire protection systems.				
2	To understand design principles related to water-based fire protection systems and carry out basic design calculations for these systems.				
3	Identify design standards/codes and use guidelines provided in these documents for proper design and installation.				
4	Understand the importance of testing and maintenance in effective functioning of fire protection systems, and interpret code and industry requirements related to ITM				

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1: Importance of water as an extinguishing agent; its physical properties which make it suitable for fire protection, with simple calculations. Different categories 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. **Practical:** - Site visit	20%	10 hours	Presentation, Video presentation Chalk board

Unit 2: Fire Hydrant systems - categorization as per applicable codes. Water Supply & Pumping arrangements: Assessing firewater requirements based on code and design guidelines (NBC Part 4, IS:13039, OISD standards). Types of firewater storage arrangements. Firewater Pumps, types and arrangements commonly applied in the industry. Wet riser arrangement, external fire hydrant system, ring main piping and layout, provision of isolation valves, hydrants, monitors, fire brigade inlets and other accessories based on hazard category and design codes and guidelines.	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**:** Types of Sprinklers system and their application and characteristics. Design guidelines for sprinkler systems including pumping systems, alarm valves and sprinkler types and rating. Medium and High velocity water spray systems, their suitability, design guidelines and installation requirements as per relevant design and installation codes. Use and function of deluge valves in HVWS & MVWS systems. Water mist systems - categories, application and limitations. Understanding on the functioning and effectiveness of water mist for specified fire hazards, methods of generating mist, system hardware, installation practices and current codes.	20%	14 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: The need and effectiveness of firefighting foams on Class B fires. Categorization of firefighting foams based on expansion ratio, their application and effectiveness based on hazards. Different type of foam concentrates and their suitability. Design guidelines for standard foam systems for different types of storage tanks as per OISD and NFPA standards, including basic calculations and system specifications. Other types of foam application, their uses and limitations.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Importance of inspection, testing and maintenance practices for water-based fire protection systems, code requirements and current practices	20%	8 hours	Presentation, Video presentation, Chalk board, Notes
LEARNING RESOURCES			

TEXTBOOKS	1. Arthur E. Cote, Fire Protection Handbook, Volume 1, Section-15 & 16, NFPA, USA 2. Fire Service Manual, Volume 3, Fire Safety, Fire Protection of Buildings, HMSO Books 3. Fire Service Manual, Volume 1, Firefighting foam - Technical, HMSO Books 4. Relevant codes: IS:13039 -Fire Hydrant System, IS:15105 – Sprinkler Systems, IS:15301 – Fire Pumps, IS:15325 – Water Spray Systems, OISD-116, 117 5. NFPA codes - 11-Foam systems, 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 6. Robert M Gagnon, Designer's Guide to Automatic Sprinkler Systems
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks

End Semester Marks	50 marks	
Continuous Evaluation Marks (50 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Assignment	30 MARKS
	Skill enhancement activities / case study	8 MARKS
	Presentation/ miscellaneous activities	7 MARKS

Course Outcomes	Students will be able to identify and describe different water-based fire protection systems currently installed in industry and buildings, based on occupancy and/or specific hazards.
	Students will be able to carry out fundamental design calculations for water-based fire protection systems and prepare basic layouts and specifications for different systems
	Students will be able to identify and use code requirements for different water-based fire protection system.
	Students will appreciate the importance of ITM in effective functioning of fire protection systems and be able to identify important ITM requirements for water-based systems

BSFS403	ELECTRICAL SAFETY	L	T	P	C
		4	2	0	6
Total Credits: 6	Total Hours in semester: 60 hrs		Total Marks:150		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To provide fundamental understanding of electricity and current electrical systems in the country.
2	To gain knowledge of electrical generation, transmission and distribution systems and associated hazards
3	Become familiar with and understand the function of safety devices and equipment employed in electrical systems.
4	To understand concepts of static electricity and electrical equipment in hazardous atmospheres
5	To get exposed to commonly applied codes and standards related to electrical safety

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Fundamentals of electricity and electrical systems - electrical units, concept of resistance and related factors, type of conductors, and insulators, construction of commonly used electrical cables and their properties. The phenomenon of short circuit and causative factors. Protective devices used in electrical circuits such as fuses, circuit breakers and their importance.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Different types of power generating stations, important equipment, units and basic design. Transmission systems, primary and secondary distribution, transmission lines, primary and secondary sub-stations, high and low voltage systems. Safety and fire hazards associated with power generating and transmission and distribution systems and protective systems/ devices used.	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**:** Substation equipments, different types of transformers – their working principles and applications, associated faults and hazards, protection systems and devices. Different fire protection systems and equipment currently being employed for protection of transformers. Internal distribution systems (low and high voltage, single phase & Three-phase low voltage), protection devices and systems required.	20%	14 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Understanding static electricity – mechanism of generation, hazards affecting different industries and processes, different methods and systems employed in industry for controlling static electricity generation and accumulation. The concept of hazardous are classification for areas likely to have hazardous atmospheres, and different electrical equipment employed in hazardous areas, their suitability, working principle and characteristics.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Exposure to different Indian Standards related to electrical safety - IS 1646 – 1961 Code of Practice for Fire Safety of Buildings (General) Electrical installations, IS 3034 – 1961 Code of Practice for fire safety of industrial buildings Electrical Generating and distribution stations, IS 2206 (Part – I) – 1962, Specifications for flame-proof electric lighting fitting, IS 2148 – 1968 Specifications for Flame Proof Enclosures of Electrical apparatus.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	• Fire Service Manual, Volume 2, Fire Service Operations, Electricity, HMSO Publications • J. Maxwell Adams, Electrical Safety a Guide to the Causes and Prevention of Electrical Hazards, IEE Power series-19.

	• D.C. Winburn, Practical Electrical Safety, Marcal Dekker. • S. Rao, Saluja, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers Arthur E. Cote, Fire Protection Handbook, Volume 1, Section 9 & 11, NFPA, USA
REFERENCE BOOKS	H.S. Kalsi, Electronics Instrument, TMH. K. Sawhney, Instrumentation & Measurement, Dhanpat Rai & Co.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	70 marks

Continuous Evaluation Marks (50 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Assugnment	30 MARKS
	Skill enhancement activities / case study	8 MARKS
	Presentation/ miscellaneous activities	7 MARKS

Course Outcomes	Students will learn fundamentals of electricity and electrical systems, their basic function, working and associated hazards.
	Students will be able to explain electrical generation, transmission and distribution systems currently being employed.

	Students will be able to explain hazards associated with electrical systems and different safety devices and systems used, their function and operation.
	Students will be able to describe hazards arising out of static electricity and use of electrical equipment in hazardous atmospheres, and preventive and mitigative practices and systems applied
	Students will get exposed to important codes and code requirements related to electrical safety

	CHEMICAL SAFETY FOR INDUSTRIES	L	T	P	C
		4	0	0	4
Total Credits: 4	**Total Hours in semester: 45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	To become aware of the hazards associated with different chemicals and how these can affect man and the environment through case studies.
2	Understand how the different chemical hazards are quantified and important systems/methodologies adopted for the same
3	To learn about the different control measures/systems adopted in industries to control the risk associated with chemicals
4	To become aware of MSDS structure and use, and be able to interpret critical safety data
5	Understand emergency response actions required for major incidents involving chemicals

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Important properties of hazardous chemicals related to flammability, toxicity, reactivity. General principles of chemical exposure and toxic response: Chemical exposure and cancer, chemical exposure and hypersensitivity, toxic response of lungs, liver, kidney, skin chemical exposure and health risk assessment. Important case studies – Bhopal (1984), Seveso (1976), Vizag (1990)	20%	7 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Different hazard rating systems and their interpretation – NFPA diamond hazard rating system, UN TDG system and its different classes. Risk assessment for chemicals such as toxic release and dispersion models (source model, dispersion model, Pasquill- Gifford model), effect of release momentum, buoyancy, etc.	20%	8hours	Presentation, Video presentation, Chalk board
Unit 3**:** Important hazard properties of chemicals: Flammability - vapour pressure, limits of flammability, Flash points, auto-ignition temperature, explosion potential. Stability - Experimental methods of determination, classifications of instability risk, quantative approach. Toxicity Evaluation parameter, level of toxic risk, problem posed by determination of toxicity risk level. Understanding and interpreting MSDS data related to hazardous properties of chemicals.	20%	10hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Different control measures/concepts applied for chemical safety in industries: Design – using safety studies (HAZOP, FMEA) to design safe systems, atmospheric conditions, separation of units, isolation of hazardous areas, safety features in process; Storage –proper storage of chemicals depending on properties, limiting quantities in storage; Operation: SOPs for safe handling and disposal, Work permits for abnormal situations, limiting quantities in process, safety systems (ESD, EDP), function and use of different PPE	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Understand emergency response actions in event of different major incidents involving chemicals (spills, leakage under pressure, fires, explosions). Type of specialized equipment, vehicles, PPE and resources required for different major incidents, pre-planning for different scenarios, use of DMPs – Onsite & Offsite.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	1. Fulekar M.H., Industrial Hygiene & Chemical Safety, I.K. International 2. Vyas, Mamta, Safety and Hazards Management in Chemical Industries, Atlantic Publishers, India 3. Baker, W.E. Explosion Hazards and Evaluation, Elsevier
REFERENCE BOOKS	•
Journals & Periodicals:	**NIL**

Other Electronic Resources:	**NIL**	
Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	20 marks	
End Semester Marks	70 marks	
Continuous Evaluation Marks (10 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	Students will understand the hazards associated with different chemicals and their effects on humans as well as environment.	
	Students will be able to describe important methods/systems being applied for quantification of chemical hazards.	
	Students will learn about different control measures/systems adopted in industries for controlling chemical risks.	
	Students will become familiar with MSDS structure and be able to interpret critical safety data.	
	Students will understand emergency response actions required for major incidents involving chemicals.	

FIFTH SEMESTER

BSCFS501	**Disaster Risk Management**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
Total Credits: 4	**Total Hours in semester: 30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:**
2	**Course Category:**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To introduce inter-relationship between disaster and development.
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	**Weightage**	**Contact hours**	**Pedagogy**
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%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Disaster Management Cycle and Framework Disaster Management Cycle – Paradigm Shift in Disaster Management, Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, Zonation, Microzonation, 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%	10 hours	Presentation, Video presentation, Chalk board
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%	10 hours	Presentation, Video presentation, Chalk board, Notes
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%	8 hours	Presentation, Video presentation, Chalk board, Notes
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%	7 hours	Presentation, Video presentation, Chalk board,
LEARNING RESOURCES			

TEXTBOOKS	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.
REFERENCE BOOKS	1. Goyal, S.L., Encyclopedia of Disaster Management (Vols. 1-3), Deep & Deeep, New Delhi 2. Gupta, A.K., Nair, S.S., Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi. 3. Ibrahimbegovic, A., Zlatar, M., Damage Assessment and Reconstruction after War or Natural Disaster, Springer. 4. Menshov, V.A., Perino, A.N., Urlichich, Y.M., Global Aerospace Monitoring and Disaster 5. Modh, S., Introduction to Disaster Management, Macmillian Publishers India 6. Srivastava, H.N., Gupta, G.D., Management of Natural Disasters in 7. Developing Countries, Daya Publisher NIDM AND NIDMA publications
Journals & Periodicals:	1. International Journal of Disaster Risk Reduction 2. Disaster Prevention and Management
Other Electronic Resources:	**NIL**

Evaluation Scheme		**Total Marks 100 marks**
Mid semester Marks	20 marks	
End Semester Marks	70 marks	
Continuous Evaluation Marks (10 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Practical Exam Marks	**Internal Marks**	20 MARKS

	External Marks	30 MARKS
Course Outcomes	Possess awareness to mitigate the effects of disaster	
	Contribute in capacity building measures to mitigate disasters Understanding role of science in mitigating disasters Contribute to safe society by the study of various disasters	

BSCFS503	Physical Training & Drills - 5	L	T	P	C
		0	0	2	2
Total Credits: 2	Total Hours in semester: 30 hrs		Total Marks:50		

1	**Course Pre-requisites:** Physical Training & Drills - 4
2	**Course Category: SKILL ENHANCEMENT COMPULSORY COURSES**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To learn fire ground hydraulics
2	To learn about ladder for rescue
3	To understand leadership training
4	To learn rescue techniques in confined space
5	To learn different types of foam applications

Course Content	Weightage	Contact hours	Pedagogy
Fire Ground Hydraulics **a) Water Resources,** □Under Ground water Tank, □Overhead water Tank, □Hydrants, □ Monitors □ Fixed Fire Fighting Installation b) Tactical Exercise with ladder with all type of Rescue with Firefighting. c) Different types of Tactical exercise with Leadership training. d) Confined place, forcible entry with Rescue & fire fighting, in Hazardous area.	100%	30 Hrs	Fire ground exercise, demonstration of equipment followed by practice, classroom lectures, video

e) Different types of Foam application on the Training Module.			
LEARNING RESOURCES			

TEXTBOOKS	1. Fire Service Manuals U.K. 2. NFPA U.S.A 3. Drill Manual India

Evaluation scheme	**Total Marks 50 marks**
INTERNAL	**20 marks**
EXTERNAL MARKS	**30 marks**

BSCFS504	Fire Fighting Operations	L	T	P	C
		3	0	2	4
Total Credits: 4	Total Hours in semester: 45+30 hrs		Total Marks:150		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives:**	
1	To provide fundamental understanding of Fire Service operations in terms of communication, mobilization and equipment
2	Understand operational planning, strategies and tactics applied for responding to incidents.
3	Appreciate the need for an Incident command system to handle incidents effectively and safely, and understand how it is practically applied at incidents
4	To familiarize students with operational firefighting and rescue tactics applied at common industrial and municipal incidents involving buildings, electrical systems, and refineries/petrochemical plants.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Role and organization of Fire Services within the country. Fire Service response arrangement in terms of equipment, communication and strategies being currently applied. Familiarization with communication equipment, Control room operations and mobilizing practices, Vehicle tracking and monitoring systems and radio operations and communication.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Importance of Incident Command System in managing incident response, controlling risk and improving effectiveness of response. 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 liasion.	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Understanding fires in buildings and different fire phenomena experienced by fire fighters. Importance of ventilation and different ventilation techniques being employed at incidents, including factors to be considered. Responding to fires at high-rise buildings, malls, underground buildings and basements.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Responding to fires involving electrical systems and facilities. Understanding of Generation, transmission and distribution facilities and types of fires commonly encountered in these facilities. Response required for fires in generating stations, transformers, electrical sub-stations, storage batteries/ UPS systems. Safeguards during firefighting and rescue operations involving electrical systems.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Overview of crude distillation, refining and associated processes and fire hazards. Important fire protection measures, systems and equipment provided in refineries/petrochemical plants and their application. Different scenarios such as process unit fires, fixed/ floating roof tank fires, dike spills and fires, LPG spheres, etc and firefighting tactics applied for these. Major incident pre-planning and response.	20%	7 hours	Presentation, Video presentation, Chalk board, Notes
LEARNING RESOURCES			

TEXTBOOKS	• Fire Service Manual, Volume 1, Communications and Mobilizing, HMSO Publications • Fire Service Manual, Volume 2, Fire Service Operations, Compartment Fires and Tactical Ventilation, HMSO Publications • Fire Service Manual, Volume 2, Fire Service Operations, Electricity, HMSO Publications • Fire Service Manual, Volume 2, Operational, Firefighting foam, HMSO Publications • Fire Service Manual, Volume 2, Fire Service Operations, Petrochemical Incidents, HMSO Publications
REFERENCE BOOKS	Barendra Mohan Sen, Fire protection and prevention - The essential handbook, UBS publishers.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation scheme	**Total Marks 100 marks**
Mid semester Marks	**20 marks**
End Semester Marks	**70 marks**

Continuous Evaluation Marks (10 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Students will understand the role and function of Fire Services in municipal and industrial sector and develop fundamental understanding of Fire Service operations in terms of communication, mobilizing and equipment
	Students will be able to demonstrate fundamental understanding of operational strategies and tactics employed at incidents to meet operational objectives.
	Students will be able to appreciate the importance of an Incident command system to handle incidents effectively, and describe important components/aspects of the system
	Students will understand response tactics employed by Fire services at different municipal and industrial incidents, and use of specialized equipment, media and vehicles.

BSCFS505	INDUSTRIAL SAFETY MANAGEMENT	L	T	P	C
		3	0	0	3
Total Credits: 3	**Total Hours in semester: 45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Safety Management-I
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives:**	
1	To learn the basic concept of safety and its development process up to the modern concept of SHE i.e., Safety, Health and Environment.
2	To understand the problems associated with industrial accidents, and concepts of safety technology, safety philosophy, safety psychology, principles of general management and their applicability to the safety management.
3	To understand the managerial functions of safety planning, organizing, directing and controlling for industrial safety activities.
4	To learn safety management techniques of education and training, motivation and participation of employees in safety, costs calculation

	of accidents and its relevance to safety budget and finally the MIS for safety.			
Course Content		**Weightage**	**Contact hours**	**Pedagogy**

Unit 1: 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. Safety philosophy, 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", five fundamentals of accident prevention, five "E" s of accident prevention Meaning of psychology, safety psychology and its importance, psychological factors affecting work and accidents. Theories of motivation, their application to safety, role of Management, and Safety Department in motivation. Behavior based safety (BBS) Management Program	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2. SHE Management & planning for safety - 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 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, Barriers in communication, Essentials of effective communication, group-dynamics. Team building.	20%	9 hours	Presentation, Video presentation, Chalk board Notes

Unit 3: Controlling for Safety - 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. 5. ILO and EPA Standards. Safety Education and 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. role of multimedia and communication, applications of computers, Relevance of WTO regarding SHE	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Employee 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. Statutory provisions. Approaches to compliance and violations. Economics of Safety - Cost of accidents: direct and indirect costs, usefulness to convince management. Financial costs: 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.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Management Information Systems - 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 hours	Presentation, Video presentation, Chalk board, Notes
LEARNING RESOURCES			

TEXTBOOKS	1. K.U. Mistry, Handbook of Industrial Safety, Siddarth Prakashan, India 2. Brauer R.L., Safety and Health for Engineers, Wiley, New York. 3. Occupational Safety Management & Engineering by Willi Hammer. 4. Ridley, John, Safety at Work, Butterworth Heinemann
REFERENCE BOOKS	• National Safety Council,425, North Michigan Ave, Chicago, Illinois, USA. • Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva. • Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann. • Industrial Accident Prevention by H.W. Heinrich, McGraw Hill Book Co. • Techniques of Safety Management by Dan Pederson. • Effective Safety and Health Training by Hillyer. • Occupational Health and Safety by Confer. • Environmental Health & Safety Management, Nicholas Cheunisinoff & Madelyn Graffia. Noyes (Jaico) • Safety Management, John V Grimaldi & Rollin H Simonds, All India Traveller Book Seller, Delhi. • Industrial Safety and Health Management – II Edition. C. Ray Asfahl, Prentice Hall • Safety Thoughts by Loss Prevention Association of India Ltd. • Responsible Care – A Public Commitment by Indian Chemical Manufacturers Association. • Human Factors Engineering by McCormick E.J., McGraw Hill, New York. • Industrial Safety Management by Tarafdar.

Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**
Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

	CATEGORY	**MARKS**
Continuous Evaluation Marks (20 Marks)	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Student will become aware of the basic concept of safety and its development process up to the modern concept of SHE i.e., Safety, Health and Environment.
	Student will understand safety management techniques of education and training, motivation and participation of employees in safety, costs calculation of accidents and its relevance to safety budget and finally the MIS for safety.
	Student will understand the managerial functions of safety planning, organizing, directing and controlling for industrial safety activities.
	Student will be able to explain problems of industrial accidents, and concepts of safety technology, safety philosophy, safety psychology, principles of general management and their applicability to the safety management

BSCFS506	Special Fire Suppression & Fire Detection Systems	L	T	P	C
		3	0	2	4
Total Credits: 4	Total Hours in semester: 45 hrs+30hrs		Total Marks:150		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To understand the need for non-water-based fire protection systems, and their suitability for specific hazards
2	To recognize the importance and need of different fire & gas detection methods and identify system types and suitability
3	To understand design principles of non-water-based fire protection systems and fire detection systems and be able to carry out basic design calculations for these systems.
4	Identify design standards/codes for above systems and use guidelines provided in these documents for proper design and installation.
5	Appreciate the importance of inspection, testing and maintenance in effective functioning of fire protection and fire & gas detection systems, and interpret code and industry requirements related to ITM

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Importance of non-water based extinguishing agents; appreciate limitations of water-based extinguishing, different types of non-water based extinguishing agents, their characteristics and suitability for different fire hazards. Overview of different non-water-based fire protection systems being currently installed - CO2, Clean Agents, Dry Chemical Powder, Wet Chemical Systems.	20%	9 hours	Presentation, Video presentation, Chalk board,

BSCFS507	Legislation related to Fire & Safety				

1	
2	
3	
4	

4.1 To understand Indian Constitution.

4.2 To know the framework of Indian Constitution.

4.3 To aware role of government of the union.

4.4 To aware role of the state government.

4.5 To understand administration organization.

}	t]	} v	W
h v] W } v]] } v t 1. Meaning and important of constitution 2. Making of Indian constitution – sources SaXlient Features of Indian constitution.	20% ^	6	PPTPNo]tes v W
h v] W & v u v o Z] 1. Fundamental Rights 2. Fundamental Duties 3. Directive Principles	25%Z	8	PPT, Notes Quizzes]]
h v] W ' } v u v } (1. President of India – Election and powers 2. Prime Minister and council of ministers 3. Lok Sabha – composition and Powers RaXya Sabha – Composition and Powers	25%Z	6h v]	Lecture/ Class participation

h E ' } v u v 1. Governor – Powers 2. Chief Minister and Council of ministers 3. Legislative Assembly – Composition and Powers 4. Legislative Council – Composition and Powers 5. Features of judiciary system in India 6. Supreme Court – Structure and Jurisdiction	20%	6	Lecture/ Class participation/Quizzes
h v] æ W u] v]] 1. Federalism in India – features 2. Local Government – Panchyats and Powers and functions 73rd and 74th Amendments 3. Election Commission – Organization and functions CitXzen Oriented Measure – RTI and PIL – Provisions and Significance.	10%K	P 4 v	]Cases Analysis a]nd } v discussion, Class participation v

>

1.	Textbooks: Introduction to the constitution of India, Durga Das Basu LexisNexis
2.	Reference Books: 1. Indian's Constitution by M.V. Pylee , New Delhi S. Chand Publication ThXe Constitutional Law of India by J.N. Panday Allahabad Central Law Agency CoXnstitution of India by National Portal of India https://www.india.giv.in/sites/upload-files/coi_part_full.pdf

o	] } v ^ Z u d } o D l	
D	30u D l	
v ^	50 u D l	
} v] v D l	Attendance	5 marks
	Quiz	5 marks
	} Skill enhancement activities / coase study Presentation/ miscellaneous	5]m}arksv 5 marks
	activities	

}	Analysis importance of Indian constitution
	know pKowers of state an}d unuion government
	Understand administration of Indian Constitution

SIXTH SEMESTER

BSCFS601	Industrial Risk Assessment & Control	L	T	P	C
		3	0	0	3
Total Credits: 3	Total Hours in semester: 45 hrs		Total Marks:100		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives:**
1	To understand concepts and terminology associated with Hazards Identification, Risk Assessment and Control Techniques.
2	To be able to evaluate and interpret risk assessment results and their practical application for risk control.
3	To appreciate the importance of risk assessment and control for MAH industries.
4	To understand Safety methodology of audit and inspection, and preparation of audit reports.
5	To understand methodology employed for carrying out risk assessments and associated techniques

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: Concept of Hazard and Risk: Definitions & Terminology for hazard and risk assessment, difference between Hazard and Risk and their co-relation, Prioritization of hazards and risks, Hazard and Risk Progression Chart, Hazard Identification, Hazard analysis, Risk analysis: Risk assessment, Risk management.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2: Hazard and Risk Analysis concepts and methods: Quantitative and Qualitative Risk analysis, Failure Mode and Effect Analysis (FMEA), Failure Mode, Effect and Criticality Analysis (FMECA), Maximum Credible Accident Analysis, Preliminary Hazard Analysis (PHA) & Hazard Analysis (HAZAN), Hazard and Operability study (HAZOP), Management Oversight Review Technique (MORT), Incident Recall Technique, Critical Incident Review Technique, Use of Safety Audit and checklists for Hazard Analysis, along with examples.	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Risk Assessment: Comparing analyzed risks with Acceptable criteria (permissible limits) and providing for further control/ safety measures to reduce risk to acceptable levels. Concept of ALARP and its application in Risk Assessment. Cost-benefit analysis for justification of control measures, if necessary. Application of different techniques such as FTA, ETA etc. Use of Computer Models.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Concept of MAH: Definition of 'Major Accident Hazard', Identification and assessment of MAH units. Criteria and Classification of Threshold Quantities of hazardous materials, Applicability of respective rules (MSIHC Rules or Rule 68-J, GFR), Compliance of statutory provisions. Assessment of Reliability of vessels and safety fittings. Data of Failure rates and its utility. Gas dispersion, Fire and Explosion Events, Assessment of probability (frequency) and consequence (effect) of such hazardous events. Scenario identification and Consequence Analysis. Computer modeling: Population density, Vulnerable zones, Probit equation & percentage fatality, Types of damage and damage distances. Risk counter, F-X and F-N curves, Criteria for acceptable risks, Assessment and Areas of Evacuation.	20%	7 hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: Safety Audit, Safety Report and Risk Assessment Report, Preparation of Safety audit as per IS:14489, Preparation of Risk Assessment Report and its compliance, Preparation of Safety Report, use of identified risks and scenarios from Safety Audit, Safety Report and Risk Assessment Report for emergency planning.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes
LEARNING RESOURCES			

TEXTBOOKS	• Handbook of Industrial Safety by K.U. Mistry, Siddarth Prakashan, India • Chemical Process Safety Fundamentals with Applications by Daniel A Crawl & Joseph F Louvar, Prantice Hall, New Jersey • Methodologies for Risk & Safety Assessment in Chemical Process Industries, Raghvan K.V., Khan A.K., Commonwealth Science Council, London. • Guidelines on Compilation and Assessment of a Safety Report for Major Accident Hazard Factories/Installations by Central Labour Institute, Sion, Bombay. • Technical Guidance on Hazard Analysis by National Safety Council.
REFERENCE BOOKS	• Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva. • Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann. • Major Hazard Control – A Practical Manual, ILO, Geneva. • Effects and Damage Calculations of Accidents with Hazardous materials, M. Molag, TNO Course Book – Risk Analysis, Netherland • Gas Dispersion Modeling, Engineers India Ltd., Central Labour Institute, Mumbai. • IS 3786 Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Accidents. • IS 14489 Code of Practice for Occupational Safety & Health Audit. • Emergency Preparedness by MOEF through ICMA publication.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**
Evaluation Scheme	**Total Marks 100 marks**

Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	Students will demonstrate understanding of concepts and terminology associated with Hazards Identification, Risk Assessment and Control Techniques.	
	Students will understand the methodology employed for carrying out risk assessments and associated techniques.	
	Students will be able to evaluate and interpret risk assessment results and their practical application for risk control	
	Students will appreciate the importance of risk assessment and its application for MAH industries.	
	Students will get exposed to Safety methodology of audit and inspection, and preparation of audit reports	

BSCFS603	Industrial Health & Hygiene	L	T	P	C
		4	0	0	4
Total Credits: 4	Total Hours in semester :60 hrs		Total Marks:100		

1	**Course Pre-requisites:** Legislation related to Safety, Health, Environment & Fire
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**	
1	To acquaint the students with adverse health effects arising out of industrial hazards, associated risks and consequential occupational diseases
2	To provide adequate job knowledge on both engineering and medical controls.
3	The important aspects of Industrial Hygiene, Ergonomics, Occupational Health, Physiology and Personal Protective Equipment are included
4	To sharpen their knowledge about different aspects of Occupational Health and preventive measures including hygiene habits expected out of the working force.
5	Deployment of Industrial Hygienists and their effective functioning in industry is still under developmental stage in our country. Accordingly, knowledge of this area will facilitate the efforts to enhance better liaison among the work of Safety Officer, Industrial Hygienist and Occupational Health Specialist or Factory Medical Officer

Course Content	Weightage	Contact hours	Pedagogy

Unit 1: INDUSTRIAL HYGIENE: Co-relation between Industrial Hygiene & Health-Definition of Industrial Hygiene (IH).-Difference between Industrial Hygiene & Occupational Health.-Work co-ordination between Industrial Hygienist, Safety Officer and Factory Medical Officer to enhance overall development of health and safety among employees-Occupational Health Hazards.-Introduction & Classification of Occupational Health Hazards.-Dangerous properties of chemicals, dusts, gases, fumes, mists, vapors, smoke and aerosols and their health effects.-Routes of Entry & Toxic Effects-Routes of entry to human system.-Recognition, evaluation and control of basic hazards.-Concepts of dose response relationship and bio-chemical action of toxic substances.-	20%	12 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2: Toxicity and Toxicology.-Types and Degrees of toxic effects.-Threshold Limits of Exposure – PEL, TLV- TWA, STEL-TWA, IDLH, LD/LC etc.-Air Sampling Methods and Strategies, instruments and analysis.-Types of Monitoring:-Workplace or Area monitoring.-Air quality and Stack monitoring.-Personal exposure monitoring.-Biological monitoring.-Methods of Sampling & Analysis.-Control Methods: -Substitution, Changing the process, isolation, wet method, local exhaust ventilation.-Personal hygiene.-Housekeeping and maintenance. Waste disposal. -Special control measures. **ERGONOMICS:** Introduction: -Introduction to Ergonomics and its constituents. -Application of Ergonomics for Safety & Health.	20%	12hours	Presentation, Video presentation, Chalk board Notes
Unit 3: OCCUPATIONAL HEALTH HAZARDS: Adverse health effects of noise, vibration, cold, heat stress, improper-illumination, thermal radiation, X-rays, UV rays, ionizing and non-ionizing radiations. -Effects of Threshold Limits: -Short term and long-term effects of exposures. -Preventive and control measures. Different Statutory Forms for filing medical reports-First-Aid-First Aid for Burns, Fractures, Suffocation, Toxic Ingestion, Bleeding, Wounds and Bandaging. Artificial Respiratory techniques. -First aid and Antidotes for poisoning of different types	20%	12 hours	Presentation, Video presentation, Chalk board, Notes

Unit 4: OCCUPATIONAL HEALTH-Definition as per World Health Organization. -Occupational Diseases: -Common occupational diseases. -Notifiable diseases under Schedule III of the Factories Act 1948.-Occupations involving risk of contracting these diseases. -Mode of causation of the diseases and their effects. - Diagnostic methods. -Biological monitoring. Methods of detection and prevention. -Evaluation of injuries. -Occupational Health Services at the work place: -occupational Health Center. -Ambulance van. -Factory Medical Officer, Staff and Equipment. -Medical Examinations: -Pre-employment and periodical medical examinations of the workers. -Medical surveillance for control of occupational diseases and health records	20%	12hours	Presentation, Video presentation, Chalk board, Notes
Unit 5: PHYSIOLOGY: Physiology of respiration:-Cardiac cycle, Muscle contraction, Nerve conduction system, etc.-Assessment of Workload based on Human physiological reactions.-Permissible limits of load for Manual lifting and carrying.-Criteria for fixation of limits.-Aerobic work capacity (physical work capacity):-Methods of determination (use of bicycle, ergometer, treadmill, step-stool ergometer).-Factors affecting Aerobic capacity and Work performance.-Working posture: Effect on Cardio-vascular and Musculo-skeletal system.-Implications on health.-Assessment of Work Capacity:-Fatigue and Rest Allowances.-Physiological test for assessment of occupational health.-Good Nutrition related requirements; intermittent dieting, types of appropriate workout exercises to remain physically fit	20%	12 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	• TLVs & BEIs by ACGIH 2021 • The Indian Factories Act, 1948 • The Occupational Environment — Its Evaluation, Control, and Management 3rd Edition by AIHA • Fundamental of Industrial Safety & Health BY Dr. K U Mistry • Toxicology Principles by William • Fundamentals of Industrial Hygiene by Barabara Plog • Recognition of Health Hazards in Industry by William A • OSHA 1910.132 PPE • Occupational Disease by NIOSH Instructional Module

REFERENCE BOOKS	**NIL**	
Journals & Periodicals:	**NIL**	
Other Electronic Resources:	**NIL**	
Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Students will be able to explain the behavior of structures under the influence of fire and the need for structural fire protection
	Students will become familiar with code provisions related to structural fire protection and compartmentation
	Students will understand the behavior of different construction materials when exposed to fires and currently applied methods to improve their fire resistance.
	Students will appreciate the role of compartmentation in fire safety and the different methods employed for need for specialized equipment and systems employed in these industries, and understand their functional requirements

BSCFS604	Building Fire Prevention & Protection Measures	L	T	P	C
		3	0	2	4
Total Credits: 4	Total Hours in semester: 45 hrs +30 hrs		Total Marks:150		

1	**Course Pre-requisites:** nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To provide fundamental understanding of Building design with respect to fire and life safety.
2	Understand building occupancies and their characteristics and how these influence fire safety design aspects
3	Recognize the importance of fire prevention in buildings and how this is achieved in practice.
4	Become familiar with life safety and fire protection arrangements in buildings and their design aspects.
5	Introduce students to basic code requirements/ rules for buildings, which need to be applied from fire safety point of view.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: General Principles of Fire Prevention and Protection: Occupancy classification of buildings and zoning of city areas. Site requirements, type of construction required with respect to fire resistance, fire separation, compartmentation, isolation.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
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 building systems i.e., electrical, HVAC, service ducts, fuel gas supply. Compartmentation and segregation of hazardous areas. Code requirements with respect to fire prevention.	20%	10 hours	Presentation, Video presentation, Chalk board Notes

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, egress design calculations, and associated systems such as emergency lighting, signage, smoke control, etc. Design requirements for egress components i.e., doors, stairs, ramps and related code provisions.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 4: Common fire protection systems for buildings: Portable extinguishers, Rising mains-wet & dry, sprinkler systems, drenchers, etc. Special systems such as water spray systems, clean agent, foam systems, water mist, etc. Understand requirements of different fire protection systems based on occupancy and building characteristics, and related code provisions.	20%	9hours	Presentation, Video presentation, Chalk board, Notes
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%	6 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	• Fire Service Manual Volume 3 Fire Safety, Fire Protection of Buildings, HMSO Publications • Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers. • Dr. Than Singh Sharma, Fundamentals in building design. • Lon H. Ferguson, Fundamentals of Fire Protection for the Safety professional, The scarecrow Press, Inc.
	• National Building code of India 2016, Part-4, BIS • NFPA Fire protection Handbook, Section 1, 20th Edition.
REFERENCE BOOKS	• Hurley, Morgan, Section 1, SFPE Handbook, SFPE/NFPA, USA

Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

	CATEGORY	**MARKS**
Continuous Evaluation Marks (20 Marks)	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	1. Students will able to explain design features of building from a fire and life safety point of view.
	2. Students will be able to explain classification of buildings and code requirements such as construction elements, building services and features based on occupancy.
	3. Students will able to explain concepts and code requirements related to fire prevention in buildings.
	4. Students will understand concepts related to life safety and fire protection as applied in buildings and how they are applied in practice.
	5. Students will become familiar with code requirements/rules applied for fire & life safety design in building.

BSCFS605	INDUSTRIAL SAFETY MANAGEMENT-2	L	T	P	C
		3	0	0	3
Total Credits: 3	Total Hours in semester :45 hrs		Total Marks:100		

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To familiarize with different Accident Indices for Safety Performance monitoring
2	Demonstrate knowledge and skills in 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 the concept of total loss control concept and its components.

Course Content	Weightage	Contact hours	Pedagogy
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%	10 hours	Presentation, Video presentation, Chalk board, Notes
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%	18 hours	Presentation, Video presentation, Chalk board Notes

Unit 3: 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%	14 hours	Presentation, Video presentation, Chalk
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%	10 hours	Presentation, Video presentation, Chalk board, Notes

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 plans	20%	8 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	• K.U. Mistry, Handbook of Industrial Safety, Siddarth Prakashan, India • Manning Michael, So You are the Safety Director, 3rd Ed, Government Institutes Inc, • Ian Long, Simplicity in Safety Investigations: A Practitioner's Guide to Applying Safety Science 1st Edition (Kindle edition) • P.K. Singh, Accident & Incident Investigation: (with Training Guide & Report Writing) (HSE Book 1) (Kindle edition)
REFERENCE BOOKS	• Heinrich H.W. Industrial Accident Prevention McGraw - Hill Company, New York, 1980. • Krishnan N.V. Safety Management in Industry Jaico Publishing House, Bombay, 1997. • Lees, F.P., Loss Prevention in Process Industries Butterworth publications, London, 2nd edition, 1990. • John Ridley, Safety at Work, Butterworth and Co., London, 1983. • Dan Petersen, Techniques of Safety Management, McGraw- Hill Company, Tokyo, 1981.
Journals & Periodicals:	**NIL**

<table>
<tr><td colspan="2">Other Electronic Resources:</td><td colspan="2">NIL</td></tr>
<tr><td colspan="2">Evaluation scheme</td><td colspan="2">Total Marks 100 marks</td></tr>
<tr><td colspan="2">Mid semester Marks</td><td colspan="2">30 marks</td></tr>
<tr><td colspan="2">End Semester Marks</td><td colspan="2">50 marks</td></tr>
<tr><td rowspan="5">Continuous Evaluation Marks (20 Marks)</td><td>CATEGORY</td><td>MARKS</td></tr>
<tr><td>Attendance</td><td>5 MARKS</td></tr>
<tr><td>Quiz</td><td>5 MARKS</td></tr>
<tr><td>Skill enhancement activities / case study</td><td>5 MARKS</td></tr>
<tr><td>Presentation/ miscellaneous activities</td><td>5 MARKS</td></tr>
<tr><td rowspan="5">Course Outcomes</td><td colspan="2">Students will become familiar with different Accident Indices & systems applied for Safety Performance monitoring.</td></tr>
<tr><td colspan="2">Students will be able to demonstrate knowledge of Basic concepts and techniques of Safety Management</td></tr>
<tr><td colspan="2">Students will become familiar with accident investigation techniques, reporting formats and accident data analysis.</td></tr>
<tr><td colspan="2">Students will understand the application of different safety appraisal and control techniques in industry</td></tr>
<tr><td colspan="2">Students will be aware of the concept of total loss control applied in industries, and its components</td></tr>
</table>

BSCFS607	Case study, Fire Scene Reconstruction & Investigation	L	T	P	C
		3	1	0	4

Total Credits: 4	Total Hours in semester :45 hrs	Total Marks:100

1	**Course Pre-requisites:**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives:**

1	To appreciate the importance of fire scene reconstruction and fire investigation from safety, research and underwriting point of view.
2	To understand the concepts and techniques used for forensic fire analysis.
3	To be able to use the knowledge of fire dynamics and fire/smoke growth & movement to reconstruct fire scenes, and identify causes of fire origin.
4	To be able to interpret the behavior of different fuels involved and performance of fire safety/other systems, in fire incidents and their impact on fire scene reconstruction.
5	Prepare technical reports related to fire scene reconstruction and investigation.

Course Content	Weightage	Contact hours	Pedagogy

Unit 1: Appreciate the importance of fire investigation and fire scene reconstruction, and its inputs to different aspects related to fire and life safety. Contribution of fire investigations and understanding cause of a fire and origin, to better and targeted inspections, public awareness programs, and code changes. It also reveals factors concerning fuel and ignition sources, building and fire suppression systems, which can be used to improve building codes, fire safety design standards, as well insurance loss adjustment and underwriting aspects.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2: The incident reconstruction and failure analysis process: development of a time history for the incident, identifying the location of the fire origin, and establishing the factors that led to ignition and that increased or lessened the severity of the loss. Pre-fire and trans-fire events and their impact on the incident. Failure analysis i.e., the design, construction and performance aspects of the incident. Look at requirements (including qualifications/experience of investigator/ process to be followed, etc) of related standards (NFPA 921)	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Basic steps and activities involved in the investigation process – examination of the scene, photographic and digital evidence, fire scene documentation, fault mapping, on-scene investigation and collection of relevant data. Developing a hypothesis and supporting the same using collected evidence, data and calculations.	20%	14 hours	Presentation, Video presentation, Chalk
Unit 4: Eliminating hypothesis which cannot be supported using fire dynamics principles and fire calculations. Important concepts and equations used in estimating fire growth, smoke development and movement, heat transfer, etc. Testing material properties for supporting hypothesis – current methods and equipment used, testing protocols to be followed.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 5: Preparing reports for fire investigations and fire scene constructions – legal aspects and requirements. Presenting evidence and exhibits in court of law. Use of relevant standards for preparing reports and practical report writing/ project.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes

LEARNING RESOURCES

TEXTBOOKS	○A Guide to Fire Investigation, IFE02, The Institution of Fire Engineers, HMSO Publications ○NFPA Fire protection Handbook, Section 3, 20th Edition. ○NFPA 921 – Guide to Fire & Explosion Investigations, NFPA, USA ○Kirk's Fire Investigation (7th Edition), Brady Fire, 2011
REFERENCE BOOKS	○ Icove, De Haan, Forensic Fire Scene Reconstruction, 2nd Edition, Brady fire, 2009

Journals & Periodicals:	**NIL**	
Other Electronic Resources:	**NIL**	
Evaluation scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
	CATEGORY	**MARKS**
	Attendance	5 MARKS

Continuous Evaluation Marks (20 Marks)	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will able to explain the importance of fire investigation and fire scene reconstruction from fire prevention, fire protection, insurance and legal point of view.	
	2. Students will be able to describe the concepts used and techniques applied for forensic fire analysis.	
	3. Students will able to apply the knowledge of fire dynamics, fire growth and development to fire scene reconstruction and identification of causes of fire origin.	
	4. Students will be able to explain the behavior of fuels and reaction of fire protection and building systems to fire, and their impact on fire growth and development.	
	5. Students will gain exposure to the preparation of technical fire investigation reports, important sections, supporting evidence, documentation and data, and other legal aspects.	