PAAVAI ENGINEERING COLLEGE, NAMAKKAL

B.E. SAFETY AND FIRE ENGINEERING

REGULATIONS 2019

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM & SYLLABUS

SEMESTER VII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	SF20701	Transportation Systems and Safety	3	0	0	3
2	PC	SF20702	Principles of Industrial Management	3	0	0	3
3	PC	SF20703	Safety in Petroleum and Petrochemical Industries	3	0	0	3
4	PE	SF2035*	Professional Elective-III	3	0	0	3
5	PE	SF2045*	Professional Elective-IV	3	0	0	3
6	OE	SF2090*	Open Elective-II	3	0	0	3
Practical							
7	PC	SF20704	Industrial Training	0	0	2	1
8	PC	SF20705	Fire Engineering Laboratory	0	0	2	1
9	EE	SF20706	Project Work (Phase I)	0	0	6	3
Total				**18**	**1**	**10**	**23**

PROFESSIONAL ELECTIVE – III

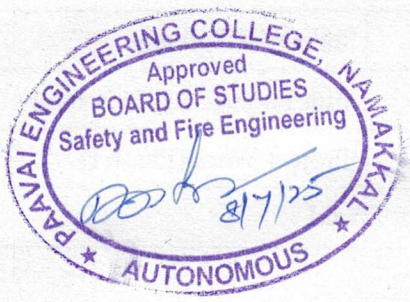
S.No.	Category	Course Code	Course Title	L	T	P	C
HEALTH AND RADIATION SAFETY							
1	PE	SF20351	Safety and Standards in Industries	3	0	0	3
2	PE	SF20352	First Aid and Emergency Procedures	3	0	0	3
3	PE	SF20353	Radiation Protection	3	0	0	3
4	PE	SF20354	Nuclear Safety and Radioactive materials	3	0	0	3

PROFESSIONAL ELECTIVE – IV

S.No.	Category	Course Code	Course Title	L	T	P	C
SAFETY IN INDUSTRIES							
1	PE	SF20451	Facility Layout and Safety in Material Handling	3	0	0	3
2	PE	SF20452	Safety Aspects of Integrated Product Development	3	0	0	3
3	PE	SF20453	Safety in Construction Industry and Town Planning	3	0	0	3
4	PE	SF20454	Safety in Automotive design and Control	3	0	0	3

OPEN ELECTIVE – II

S.No.	Category	Course Code	Course Title	L	T	P	C
1	OE	SF20903	Rescue Equipment and Techniques	3	0	0	3
2	OE	SF20904	Fire Safety Engineering	3	0	0	3



SF20701	TRANSPORTATION SYSTEMS AND SAFETY	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	get good value for money in relation to impacts on public account
2	health and safety objectives are useful to create a health and safety program that aims at reducing harm to your employees.
3	increase the visibility of the business health and safety expectations across all stakeholders, including suppliers and customers
4	your organization may find it appropriate to have more than one objective, depending on the health and safety environment of the workplace.
5	set the stage for measuring performance and identifying opportunities for improvement.

UNIT I	RAILWAY ENGINEERING	9

Introduction of Railway Engineering: Permanent way. Curves, super-elevation, negative super elevation, transition curve, grade compensation on curves. Railway operation and control – points and crossings turn-out. Signalling and interlocking. Centralized traffic control Railway accidents & safety. Rapid transit railways - types, merits & demerits.

UNIT II	HIGHWAY ENGINEERING	9

Introduction of Highway Engineering: AI-Based Classification and Analysis of Highway Types and Urban Road Patterns - Typical cross section of roads. Factors controlling the alignment of roads. Basic geometric design - stopping and overtaking sight distances.

UNIT III	TRAFFFIC ENGINEERING	9

Introduction of Traffic Engineering: Traffic characteristics. Various traffic studies and their applications. Traffic signals. Carriage-way markings. Traffic islands. Highway intersections. Principles of highway lighting. Road Accidents - prevention, investigation and reduction.

UNIT IV	HARBOUR AND DOCK ENGINEERING	9

Introduction of Harbour& Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports. Layout of ports - AI-powered Automated Guidance Systems for Vessel Navigation in Ports - breakwater, facilities (in brief) for docking, repair, approach, loading and unloading, storing and guiding.

UNIT V	AIR TRANSPORTATION ENGINEERING	9

Classification of air transportation, Types of air craft engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion -Applications –Air way accidents & safety.

TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	apply the knowledge of railway track components, materials and fixtures and fastenings.	Analysing (K4)
CO2	solve problems of railway track geometrics, train resistance, points and crossings, signalling and control system.	Understanding (K2)
CO3	understand elements of highway safety and approaches to accident studies.	Applying (K3)
CO4	understand elements of highway safety and approaches to accident studies.	Understanding (K2)
CO5	explain the significance of ports and harbours as a mode of transport. ozha & ozha, dock and harbour engineering.	Analysing (K4)

TEXT BOOKS

1. John Khisty C, Kent Lall B, "Transportation Engineering – An Introduction, 3rd Edition, Prentice Hall of India, New Delhi, 2002
2. B.S.Dhillon, Transportation systems, reliability and safety" CRC Press,2011

REFERENCES

1. Chandra, S. &Agarwal, M. M. "Railway Engineering". Oxford University Press, New Delhi,2007
2. Khanna, S. K. and Justo, C. E. G., "Highway Engineering" (9th edi).Nem Chand & Brothers, NewDelhi, 2001.
3. Geetham Tiwari& Dinesh Mohan, "Transport Planning & Traffic safety"
4. Srinivasan, R., "Harbour, Dock and Tunnel Engineering" Charotar Publishing House Pvt. Ltd, Anand, 2013.

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	-	1	1	-	-	-	-	-	1	-
CO2	-	1	-	-	1	2	-	-	-	1	-	-	3	-
CO3	2	-	-	-	-	1	-	1	1	-	-	-	-	-
CO4	2	1	2	-	1	1	-	-	-	-	-	-	-	1
CO5	1	-	2	-	-	-	-	-	-	-	-	1	-	-

SF20702	PRINCIPLES OF INDUSTRIAL MANAGEMENT	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the structure, elements, and types of organizations along with foundational management principles.
2	explore motivation, leadership, recruitment, training, wage systems, and industrial relations.
3	introduce production systems, forecasting, capacity and inventory planning.
4	impart knowledge on project appraisal, feasibility studies, and scheduling techniques.
5	develop understanding of strategic planning, formulation, and global corporate strategies.

UNIT I	ORGANIZATION	9

Introduction of Organisation : Concept of organization, characteristics of organisation, elements of organization, organizational structure, organisation charts, Types of organisation- line & staff organization, functional organisation, project organisation, matrix organisation, Management: Functions, Evolution of management theory, Principles of scientific management,

UNIT II	PERSONAL MANAGEMENT	9

Introduction of Personnel Management: Motivation theories, Leadership theories and Management on successful completion of the course the student will be aware of PM, Recruitment and training, labour turnover, operator training, Wages and Incentives: feature of wages, time and piece rate, incentive plans, profit sharing. Job evaluation, Merit rating methods- factors of comparison and point rating-defects. Industrial Relations: industrial disputes, collective bargaining, trade unions, workers´ participation in management, labour welfare.

UNIT III	PRODUCTION MANAGEMENT	9

Introduction of Production Management: Production System-Functions-Product based on successful completion of the course the student will be aware of production management -Product Life Cycle. Demand forecasting for operations - components of demand - methods of prediction and forecasting - forecasting models - casual & time series PPC-Functions – Models Capacity Planning - Evaluating future capacity - capacity requirement - Aggregate Planning Inventory Control-Objectives-Costs-Models: Basic, Production, and Shortage-ABC Analysis.

UNIT IV	PROJECT MANAGEMENT	9

Introduction of Project Management: Project Appraisal - Feasibility Analysis, Market feasibility, Technical feasibility, Financial feasibility, Economic feasibility, Financial and Economic appraisal of a project, Social Cost-Benefit Analysis in India, Project Report. On successful completion of the course the student will be aware of Project Scheduling: Network Techniques, PERT, CPM, GANTT charts, GERT, Time cost trade ou and crashing procedure.

UNIT V	STRATEGIC MANAGEMENT	9

Introduction of Strategic Management: Vision, Mission, Goals, Strategy – Elements of corporate planning .Process - Environmental Scanning – SWOT analysis-Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives, Global strategies, Theories of Multinational Companies.

	TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	gain knowledge of organizational types, charts, and scientific management principles.	Understanding (K2)
CO2	understand key aspects of personnel management, incentive systems, and labor welfare practices.	Understanding (K2)
CO3	apply forecasting methods, manage production planning, and control inventory effectively.	Applying (K3)
CO4	capable of evaluating project feasibility and applying scheduling tools like PERT and CPM.	Applying (K3)
CO5	perform SWOT analysis and implement strategic management processes in a business context.	Understanding (K2)

TEXT BOOKS

1. John Christie Duncun,"Principles of Industrial Management",2010
2. L.P.Alford, "Principles of Industrial Management", The Ronald press company, New York

REFERENCES

1. Kootnz, H, "Principles of Management", Tata McGraw Hill Education,2004.
2. Buffa, E.S. "Modern Production and Operations Management". (Seventh edition). John Wiley and Sons,2003.
3. Prasanna Chandra. "Projects Planning, Analysis, Selection, Implementation & Review". (4th edn). Tata Mcgraw Hill, New Delhi,2005.
4. Martand Telsang. "Industrial Engineering and Production management". (2nd edn). S.Chand & Co., New Delhi.

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COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	1	-	2	2	2	2	2	2	2
CO2	3	2	2	1	-	2	1	3	2	2	2	2	2	2
CO3	3	3	3	2	2	-	-	-	2	2	3	2	2	2
CO4	3	3	3	2	2	1	1	2	2	2	3	2	2	2
CO5	3	3	2	2	2	2	2	3	2	2	3	3	2	2

SF20703	SAFETY IN PETROLEUM AND PETROCHEMICAL INDUSTRIES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	various process employed in petroleum refining and manufacturing of petrochemicals.
2	learn the fire prevention and fire protection methods employed in storage tank farms, depots, and terminals.
3	learn the on- shore and off-shore drilling.
4	learn the transportation facilities in petroleum industry
5	learn the petroleum and oil & gas explorations rules and regulations in india

UNIT I	PETROLEUM REFINERY	9

Simplified Flow diagrams of a typical refinery - distillation unit, catalytic cracker, reformer, treating unit (hydro forming, gas purification, Sulphur recovery, lubricating oil unit) Simplified Flow diagrams of Petrochemical Industry - steam cracking, butadiene extraction, ethane recovery, butyl rubber polymerization.

UNIT II	PETROLEUM HAZARDS	9

Potential fire hazards in petroleum and petrochemical industries (ignition by local sources, spark, flame, hot surface, ignition of oil mists and fumes) Storage tank farms of petroleum and petrochemical industries - Identification of Hazards, Design, Layout, Fire prevention measures including lightning protection. Fire protection arrangements in large tank farms, Design concepts of various fixed fire protection systems like Foam-Water Systems, Halogen & DCP systems. Salient features of codes / standards: NFPA, API, OISD and SHELL.

UNIT III	PETROLEUM TRANSPORTATIONS	9

Fire protection facilities in Oil Refineries, Depots & Terminals- Transportation of petroleum and petrochemical products (safety considerations, statutory considerations). Design and Construction requirements for cross country hydrocarbon pipelines. Liquefied Petroleum Gas (LPG) Bottling Plant Operations. Design Philosophies. Operating Practices- Safety and Fire Protection in bottling plants. Transportation of Bulk Petroleum Products. Storage and Handling of Bulk Liquefied Petroleum Gas.

UNIT IV	PETROLEUM WELL DRILLING OPERATION	9

On- Shore and Off- shore drilling. Classification of wells. Drilling method. Rotary drilling. Drilling equipment. Ground and offshore structures for drilling. Offshore platforms and drilling vessels. Drilling mud - functions, classification and properties. Blow-off, well kicks, Blow out preventer. Shallow gas. Directional drilling. Emergency shutdown, Methods of Rescue & Fire Fighting. Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008.

UNIT V	OIL AND GAS RULES AND REGULATIONS	9

Petroleum and Oil & Gas rules and regulations in India, The Oil fields regulations and development Act, New Exploration Licensing Policy (NELP), Functions of directorate general of hydrocarbons, Petroleum and Natural Gas Regulatory Board.

TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	identify the various processes employed in petroleum refining and petrochemical industries	Analysing (K3)
CO2	attain ability to design fire protection systems for storage tank farms	Understanding (K2)
CO3	attain ability to design fire protection facilities in oil refineries, depots and terminals	Applying (K4)
CO4	demonstrate an ability to recognize the hazards involved in on- shore and off-shore drilling	Understanding (K2)
CO5	know the oil and gas explorations rules and regulations in India	Analysing (K3)

TEXT BOOKS

1. Dennis P. Nolan,"Application of HAZOP and What if Reviews to the Petroleum, Petrochemical and Chemical Process Industries",Noyes Publications, 2010.
2. Dhananjoy Ghosh," Safety in Petroleum Industries, CRC Press,2021

REFERENCES

1. Gopal Rao, M. and Sittig, M (Eds)."Dryden´s outlines of chemical technology for the 21st century". (Third edition). Affiliated East West Press, New Delhi,2010.
2. Sam Mannan (Editor). "Lee´s loss prevention in the process industries" (fourth edition). Butterworth-Heinemann Ltd., UK,2012.
3. Davorin Matanovic. Nedilika Gaurina- Medjimurec. And Katarina Simon."Risk analysis for prevention of hazardous situations in petroleum and natural gas engineering". Engineering Science Reference, Hershey PA,2014.
4. Aven, T. and Vinnem, J.E. "Risk management with applications from the offshore petroleum industry". Springer-Verlag, U.K,2007.

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO 1	PSO2
CO1	2	-	2	-	-	-	-	-	-	-	-	2	-	-
CO2	1	-	3	-	-	-	-	-	-	-	-	-	1	-
CO3	1	2	-	2	-	-	-	-	-	-	-	1	-	2
CO4	1	-	2	1	-	-	-	-	-	-	-	2	1	-
CO5	2	-	-	-	-	2	-	-	-	-	-	-	2	1

SF20704	INDUSTRIAL TRAINING	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	know fire safety experience and knowledge which is required in industry, where these are not taught in the lecture rooms.
2	apply the fire safety knowledge taught in the lecture rooms in real industrial situations and get a feel of the work environment
3	know the fire safety responsibilities and ethics
4	identify the concept of fire safety towards the safest environment

DESCRIPTION

Industrial Training provides work experience relevant to their field of specialization, before graduation, and it is an essential component for the development of practical and professional skills required for an engineering graduate and supports for prospective employment.

At the end of the industrial training, students should be able to improve their knowledge and skills relevant to their areas of specialization where they have been trained. The students should also be able to relate, apply, and adapt the relevant knowledge, concepts, and theories within an industrial organization, and also to practice the general workplace behaviour and interpersonal skills.

The student (either in group or single) should undergo industrial training for a minimum period of two weeks during the summer vacation after the completion of fourth semester as specified in the curriculum in any research organization/university/industry of State/National and International level industry relevant to their branch of specialization, after getting proper approval from the Head of the Institution.

On the completion of the industrial training for the specified period, the student has to submit the industrial training report (at least 25-30 pages) containing the following details, along with the certificate obtained from the industry for the period of training undergone.

1. Introduction of the industry.
2. Industry layout and its various operations with its infrastructure facilities.
3. Formulation of practical problems, data required to formulate the problems and its analysis.
4. Suggestions and recommendations for the above problems

During the period of training, the student has to abide the rules and regulations enforced by the organization and to ensure FULL attendance during the period of industrial training and uphold the discipline and decorum of the institution.

On the completion of the industrial training, the End Semester Examinations shall be conducted by the Office of the Controller of Examinations at the end of the fifth semester. A three-member committee constituted by the Head of the Institution, consisting of (1) a senior faculty member at the Professor level, (2) senior faculty member at the Associate Professor and (3) faculty member from outside the department, will evaluate the industrial training

undergone by the student. The evaluation shall be made based on the report submitted along with the presentation and a Viva voce Examination.		
		TOTAL PERIODS :30
COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest level)
CO1	apply the concepts and ideas which they are learned in industry.	Applying (K3)
CO2	design and develop the concepts which needs for safety in industries.	Analyzing (K4)
CO3	explain the importance responsibilities and ethics of individual in workplace for safety.	Understanding (K2)
CO4	apply the concept of fire safety towards the safest environment.	Applying (K3)

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	1	3
CO2	1	-	-	-	-	-	-	-	-	-	-	2	1	3
CO3	2	2	-	-	-	-	-	-	-	-	-	3	2	3
CO4	3	2	2	2	2	-	-	-	-	-	-	3	3	3

SF20705	FIRE ENGINEERING LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	determine the flash and fire point of hydro carbons and effect of temperature on the viscosity of hydro carbons.
2	perform the test on portable fire extinguisher with DCP and water.
3	find out effect of temperature on concrete and masonry units.
4	select a suitable type building materials for construction under the temperature effect.

LIST OF EXPERIMENTS

1. Determination of flash Point, fire point and pour point of hydrocarbon liquids.
2. Study on the effect of temperature on the viscosity of hydrocarbon liquids using redwood viscometer.
3. Physical tests on Dry Chemical Powder as per relevant Indian standard specifications
4. Performance Tests on Portable Fire Extinguishers – AFFF, water and DCP type
5. Study of Fire Sprinkler Head Types
6. Determination of flame spread rate of materials
7. Fire Safety Inspection Checklist Preparation
8. Study on the effect of temperature on strength of building materials – Concrete and masonry units.
9. Rebound hammer test on concrete exposed to elevated temperatures.
10. Test of non-combustibility of Building Materials.

TOTAL PERIODS :30

COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest level)
CO1	determine the flash and fire point of hydro carbons and suggest suitable hydrocarbons for specific application.	Applying (K3)
CO2	experimenting the portable fire extinguisher and analyse its performance.	Analyzing (K4)
CO3	explain the effect of change in temperature on concrete and masonry units.	Applying (K3)
CO4	examine temperature effect on building materials and able to suggest suitable material.	Analyzing (K4)

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	2

SF20706	PROJECT WORK (PHASE I)	0	0	6	3

COURSE OBJECTIVES

To enable the students to

1	develop ability to identify problems and solve through project works.
2	get exposure to literature review related to identified problem and finding the gap to solve through project work.
3	get exposure to required design procedure, experimental setup, analysis methods to solve the identified problems.
4	prepare project reports and practice to face viva-voce examination..

DESCRIPTION

1. The students are expected to get formed into a team of convenient groups of not more than 4 members for a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide need to be completed within the first two weeks from the day of the beginning of 7th semester.
3. The group has to identify and select the problem to be addressed as their project work and study literature survey to finalize a comprehensive aim and scope of their work.
4. 30% of the total work of the project work has to be completed by end of 7th semester.
5. A mini project report (of the phase-I) to this effect has to be submitted by each student group.
6. Three reviews and end semester review of the progress of the project work have to be conducted by a team of faculty (minimum 3 and a maximum of 4) along with their faculty guide as a member the review team.
7. The same team of faculty will evaluate the Project Phase - I report. This evaluation will form 50% of the internal assessment mark. The remaining 50% of the internal assessment mark will be given at the end of the 8th semester, at the time of completing the full project work.

	TOTAL PERIODS :90
COURSE OUTCOMES On completion of the project work, the students will be able to	**BT MAPPED** (Highest level)
CO1 identify feasible problems to solve through project works	Analyzing (K4)
CO2 collect literature through research journals and identify the gap in selected area	Analyzing (K4)
CO3 devise the methodology to find solution through gathering complete knowledge on materials/design procedure/analysis and optimization techniques/ availability of experimental setup/ company permission and other documentation procedures to execute the project	Applying (K3)

CO4	prepare project report as per format and confidently face viva voce with proper PPT for presentation	Analyzing (K4)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	2	2	2	3	3	3	2	2	2
CO2	3	2	2	-	-	2	2	2	3	3	3	2	2	2
CO3	3	2	2	-	-	2	2	2	3	3	3	2	2	2
CO4	3	2	2	-	-	2	2	2	3	3	3	2	2	2

SF20351	SAFETY AND STANDARDS IN INDUSTRIES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the fundamentals of industrial safety principles and practices.
2	identify and assess various industrial hazards and risks.
3	implement control measures to minimize workplace accidents.
4	gain knowledge of national and international safety standards and laws.
5	analyze accident causes and recommend preventive strategies.

UNIT I	INTRODUCTION TO SAFETY IN INDUSTRY	9

Importance and need for industrial safety-Safety terminology and definition-Safety management- Structure and organization- Role of safety engineer and fire engineer in industries - Integrating AI with safety engineering to create smarter industrial workplaces - Cost of accidents: Direct and indirect- Unsafe acts and unsafe conditions

UNIT II	ACCIDENT PREVENTION AND INVESTIGATION	9

Theories of accident causation -Heinrich, Domino, Multiple causation theory- Accident investigation -procedure and report writing-Near-miss reporting-Incident/Accident analysis techniques -SCAT, Root Cause Analysis, FMEA-Safety inspection and audit.

UNIT III	INDUSTRIAL HAZARDS AND CONTROL MEASURES	9

Mechanical hazards – Guarding, interlocks- Electrical hazards – Shock, arc flash, grounding, LOTO- Chemical hazards – MSDS, handling and storage-Noise, vibration, radiation, and thermal hazards- Material handling and ergonomics- PPE and engineering controls.

UNIT IV	SAFETY LEGISLATIONS AND STANDARDS	9

Indian Factories Act, 1948 – Provisions related to health, safety and welfare-Environmental Protection Act- OSHA standards- National Safety Council (NSC), BIS safety codes- ISO 45001 – Occupational Health and Safety Management Systems.

UNIT V	FIRE PREVENTION IN INDUSTRIES	9

Classification of fires and extinguishing methods- Industrial fire hazards: Chemical plants, oil and gas industries- Fire detection and suppression systems- Emergency preparedness and response - Disaster management planning- Case studies of industrial fire incidents - Role of AI in Enhancing Firefighter Safety and Efficiency during Industrial Fire Emergencies.

	TOTAL PERIODS:45

COURSE OUTCOMES	BT MAPPED (Highest level)
At the end of the course, the students will be able to	
CO1 understand the basic concepts, importance, and principles of industrial safety in various engineering workplaces.	Understanding (K2)

CO2	identify and analyze industrial hazards and assess associated risks using appropriate techniques.	Analyze (K4)
CO3	apply accident prevention strategies and carry out safety inspections and investigations effectively.	Applying (K3)
CO4	apply safety systems, audit processes, and recommend improvements based on national/international standards.	Applying (K)
CO5	implement emergency response plans and disaster management strategies for industrial environments.	Analysing (K4)

TEXT BOOKS

1. R.K. Jain & Sunil S. Rao – Industrial Safety, Health and Environment Management Systems, Khanna Publishers
2. Crouse & Anglin – Industrial Safety and Health, McGraw Hill

REFERENCES

1. N.V. Krishnan – Safety in Industry, Jaico Publishing House
2. H.L. Resnick & David V. Maclay – Industrial Safety and Health Management, Pearson
3. Frank R. Spellman – Occupational Safety and Health Simplified for the Industrial Workplace, Government Institutes
4. Advance in Industrial Ergonomics and safety, Ruth Nieslen, Kurt Jorcensen", Taylor & Francis ,London-1993

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(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	2	1	1	-	-	-	2	-	-	-
CO2	2	2	2	-	-	1	1	1	-	-	1	-	-	-
CO3	2	2	3	-	1	1	-	-	-	-	2	-	-	-
CO4	3	2	-	2	-	1	1	-	-	-	3	-	-	-
CO5	2	2	2	-	-	2	2	1	-	-	-	-	-	-

SF20352	FIRST AID AND EMERGENCY PROCEDURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the fundamentals and relevance of first aid And Deal with Emergency situations
2	know the limits of basic first aid and Legal Perspective of First Aid, Safety at the workplace and highlights of accident Prevention
3	obtain expertise of experimentation; in know the Limits of basic first aid
4	get exposed to a wide range of duties of the employer as a First Aider
5	equip with necessary engineering skills to understand and demonstrate essential Lifesaving skills

UNIT I	INTRODUCTION	9

Aims and Objectives of First Aid principles-Role of the first aider-sequence of action on arrival at scene. Vital signs-breathing -pulse. Introduction to the body-basic anatomical terms-body cavities - head- cranium - thorax-abdomen and pelvis.

UNIT II	INJURIES-FRACTURES	9

The nervous system-functions-components -brain - cerebrum - cerebellum – medulla oblongata - cerebro - spinal fluid-spinal cord-autonomic nervous system. Unconsciousness-causes-level of consciousness-management of unconscious casualty problems of unconsciousness. Fainting recognition-management-aftercare. Diabetes - hypoglycemia - hyperglycemia- management. Seizures (epileptic fits, convulsions) features- management, stroke. Head injuries-fractures of the base-vault and sides of skull.

UNIT III	SIGNS AND SYMPTOMS	9

The respiratory system-respiratory failure - asphyxia-abdominal thrust in Heimlich man oeuvre. Chest injuries-types-fractured ribs –pneumothrox - haemothrox. The circulatory system - heat attack - chest compression- CPR Shock -causes - signs and symptoms - management of shock.

UNIT IV	CLASSIFICATION OF WOUNDS	9

Eye-eye injuries-foreign body in eye-eye trauma-corrosive chemical in eye-arc eye. Wounds bleeding-classification-types of wounds-case of wounds -bleeding from special sites. Broad and narrow fold bandages-hand bandages-slings.

UNIT V	CLASSIFICATION OF FRACTURES	9

Fractures- classification of fractures-principles of immobilization-sprains & dislocation. The skin Burns -rule of nines-pure thermal burns. Electric burns. Chemical burns. Radiation burns-cold burns Poisoning Occupational health - dermatitis-noise. Radiation ionizing Physical fitness Lifting - casualty handling. Use of stretchers.

	TOTAL PERIODS:45
COURSE OUTCOMES	**BT MAPPED** (Highest level)
At the end of the course, the students will be able to	
CO1 gain knowledge of principles of first aid	Analysing (K4)

CO2	obtain knowledge on human anatomy and safety tools during emergency	Applying (K3)
CO3	understand the nervous systems and modern engineering tool's application	Applying (K3)
CO4	handle emergency and engineering in life long process	Applying (K)
CO5	identify a range of common illnesses and injuries.	Analysing (K4)

TEXT BOOKS

1. American Red Cross First Aid-Responding to Emergencies, 4th Ed. (2007)
2. V. Yudenich, Accident First Aid, Mir Publishers, Moscow, 2010

REFERENCES

1. Manual of first aid to the injured: St. John Ambulance Association, 2001
2. First aid text book: American National Red Cross, 2009
3. Manual of First aid instruction: US Bureau of Mines, 2007
4. First Aid for the USMLE Step 1, Tao Le, Vikas Bhusan, Mathew Sochat, 2022

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	2	-	-	-	-	-	-	3	-	3
CO2	3	-	3	2	-	-	-	-	-	-	-	-	1	3
CO3	3	2	-	3	-	-	-	-	-	-	-	-	1	3
CO4	2	-	1	-	3	-	2	-	-	-	-	-	1	3
CO5	-	2	2	1	-	-	-	-	-	2	-	3	-	2

SF20353	RADIATION PROTECTION	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	provides fundamental physical concept to understand radiation
2	explain the interaction of radiation with matter and biological effects
3	explain various dosimetry quantities and how to obtain them from radiation measurements
4	provides a fundamental grounding in the theory and principles of radiation protection
5	provides knowledge to build methodology to protect workers, the public, and the environment from radioactivity and radiation using these theory and principles

UNIT I	REVIEW OF ATOMIC, NUCLEAR AND RADIATION PHYSICS	9

Atomic structure basic -periodic table - atomic radiation (x-ray, Auger electrons and electron conversion) - Molecules-Nuclear structure & stability basics-radio activity (spontaneous &induced) and radiation emission (alpha, beta, gamma, internal conversion, fission fragments) – nuclear reaction basis -solids and energy band.

UNIT II	RADIATION SOURCES, DETECTION, MEASUREMENTS AND DOSIMETRY	9

Category of radiation sources based on types (X-ray, Gamma, Neutron, Beta, Alpha and Heavy ions) and method of generation (Isotopic, Reactor based, Accelerator Based)- Radiation detectors (Gas filled, Semiconductor, Scintillation, Solid state, Emulsion, Activation) Gamma and Neutron spectrometry (using Scintillation and Semiconductor detectors)- Dose response (Relationships Affecting Factors)- Relative Biology Effectiveness- Dose rates-Oxygen Enhancement Ratio- Chemical modifiers - Dose fractionation in Radiotherapy

UNIT III	INTERACTION OF RADIATION WITH MATTER AND BIOLOGICAL EFFECTS	9

Interaction of particles (Electron, Alpha and Heavy ions) with matter- charged particle tracks type-Interaction of photons (Gamma and X-rays) with matter- Neutron interaction, fission and criticality-Basic biology (of human cell, fetus and human organs)- physical, chemical (pre & delayed) and track formation in water-chemical and biological effects (acute, delayed somatic, micro and macro level, genetic, cataract, cancer life shortening etc.-)

UNIT IV	REVIEW OF STATISTICS FOR RADIATION PROTECTION	9

Statistical nature of radiation- radioactive disintegrations (exponential decay and Bernoulli process Review of statistical distributions (binomial, Poisson and Normal)- Error and Error propagation counting radioactive sample (gross and Net count rates)- Optimum counting time- counting of shortlived samples – Minimum Significant measured Activity and Minimum Detectable True Activity Instrument's response, resolution and dead time- Radio bioassay criteria- Monti-Carlo simulation of radiation transport

UNIT V	RADIATION PROTECTION PRINCIPLES, STANDARDS AND REGULATIONS	9

Radiation protection criteria and exposure limit (objective, elements& methodology) – introduction to external and internal radiation protection- NCRP, ICRP, and AERB and its reports, guidelines and regulations - introduction to selected ICRP models (No.30&66: respiratory system, respiratory track, gastro intestinal, bones, reference man and radioactive cloud)-organs activity and transformation number-specific absorbed fraction & effective energy

TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	relate the dosimetry quantities and radiation protection standards to its scientific basis and examine it	Understanding (K2)
CO2	explain radioactivity and radiation interactions (physical & biological) and how to relate the radiation measurements to dosimetry units.	Understanding (K2)
CO3	apply the knowledge gained to categorize sources of radiation and contrast their relative hazards	Applying (K3)
CO4	analyse the biological effects and evaluate the risks of exposure to ionizing radiation.	Understanding (K2)
CO5	build procedures along with cost analysis for protecting workers, the public, and the environment from radioactivity and radiation.	Applying (K3)

TEXT BOOKS

1. Atoms, Radiation and Radiation Protection by James E. Turner, Wiley-VCH, Year: 2007
2. Radiological Protection and Safety A Practitioner Guide by Pushparaja notionpress.com

REFERENCES

1. An Introduction to Radiation Protection by Alan Martin, Sam Harbison, Karen Beach and Peter Cole,7th Edition 2019, CRC Press.
2. Radiological Assessment: Sources and Exposures by Richard E. Faw and J. Kenneth Shultis, American Nuclear Society (1999)
3. Various NCRP, ICRP, ICRU and AERB Reports
4. Radiation Detection and Measurement, 2nd Edition, Glenn F. Knoll, Wiley

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	-	-	-	-	-	-	2	-	-	-	1
CO2	2	-	1	-	-	-	-	-	-	2	-	-	-	-
CO3	2	1	-	--	2	-	-	-	-	2	-	-	-	-
CO4	2	2	-	-	-	-	-	1	2	1	-	1	1	-
CO5	2	2	-	-	2	-	-	1	2	1	-	1	1	-

SF20354	NUCLEAR SAFETY AND RADIOACTIVE MATERIALS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the basic principles of radioactivity and nuclear reactions (fission and fusion).
2	learn best practices in handling and preventing radiation emergencies.
3	identify the different applications of nuclear materials in industry, medicine, and weapons.
4	recognize the roles and responsibilities associated with nuclear safety.
5	analyze major nuclear accidents (Three Mile Island, Fukushima) and their health impacts.

UNIT I	INTRODUCTION TO RADIOACTIVE MATERIALS	9

Radio Active Material: Nuclear Reactor (Fission and Fusion) Nuclear fuel fabrication & reprocessing facilities, Basic theory Principles and Techniques of radiation dissymmetry. Techniques of area and air monitoring. Techniques of personnel radiation protection; Nuclear Materials in spent fuel and nuclear waste Responsibility for Safety, Emergency Preparedness and Response.

UNIT II	DISPOSAL OF RADIOACTIVE MATERIALS	9

Sources and characteristics of radioactive waste and their types and their method of disposal, Handing and prevention of radiation emergencies and Storage requirements of radioactive materials; The Convention on Nuclear Safety Implementing measures.

UNIT III	SAFETY HAZARDS IN RADIOACTIVE	9

Firefighting and rescue operations in the presence of radiation hazard - Pre planning of Radiation incident. Nuclear materials in industrial, medical and weapons applications - Safe handling of nuclear materials - AI-Powered detection and monitoring of nuclear materials during fire and rescue operations.

UNIT IV	SAFETY IN NUCLEAR POWER STATION	9

Responsibility for Safety; Radiation Safety in Nuclear Power Stations; Optimization of Protection; Prevention of Accidents; Emergency Preparedness and Response; Safety considerations during the various phases of the installation; safety in removal of Heat.

UNIT V	RADIOACTIVE ELEMENT DECAY PROCESS	9

Definition, Decay: classification of decay process, radioactive elements. Application of Radioactive Elements. Reactivity series and their salient features. Three Mile Island accident case study and health effects, INES (International Nuclear Event Scale) rating. Fukushima accident case study and health effects, INES (International Nuclear Event Scale) rating.

		TOTAL PERIODS:45
COURSE OUTCOMES		**BT MAPPED** (Highest level)
At the end of the course, the students will be able to		
CO1	explain the fundamental concepts of radioactive materials, nuclear reactions, and radiation protection techniques.	Understanding (K2)

CO2	describe the sources, types, and disposal methods of radioactive waste along with storage and safety conventions.	Understanding (K2)
CO3	apply radiation safety protocols during emergency scenarios such as fire fighting, rescue operations, and handling of nuclear materials.	Applying (K3)
CO4	understand the safety considerations, responsibilities, and protective measures at various stages of nuclear power station operations.	Understanding (K2)
CO5	analyze radioactive decay processes and assess the impact of major nuclear accidents using the INES scale.	Analysing (K4)

TEXT BOOKS

1. Radioactive Materials , B,m. Rao, Himalaya Publishing House.
2. Principles of Radiation Dosimetry, G .W.White ,John Wiley and Sons

REFERENCES

1. Radioactive Wastes,their Treatment and disposal ,J.C.Collins,E.F.NSpon Ltd.,
2. Environmental Redioactivity ,M.Eisembud,McGraw Hill Book Co.,
3. Industrial Safety, F.A.Patty (Ed.2007).
4. Radiation Hygiene Handbook,Henson Blat.2(Ed)McGraw Hill.

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	1	3	2
CO2	3	2	-	2	-	2	2	-	-	-	-	1	2	3
CO3	3	3	-	3	2	2	2	2	-	-	-	2	3	3
CO4	3	2	-	-	-	2	2	-	-	-	-	1	3	2
CO5	3	3	-	3	2	3	3	-	-	-	-	2	3	2

SF20451	FACILITY LAYOUT AND SAFETY IN MATERIAL HANDLING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	explain the basic principles in facilities planning, location, layout designs and material handling systems.
2	provide students with the basic concepts related to the interactions between the production system parameters and their impact on materials handling systems design.
3	provide students with methods for the generation of plant layouts.
4	provide students with information on materials handling systems design for various aspects of the manufacturing and service industry.
5	explain the basic principles in material handling and Equipment selection.

UNIT I	PLANT LOCATION	9

Introduction, Factors affecting location decisions , Location theory , Qualitative models, Semi Quantitative models -Composite measure , Brown & Gibbs model , Break-Even analysis model, Single facility location problems – Median model, Gravity location model, Mini-Max model, Multifacility location problems, Network and warehouse location problems.

UNIT II	FACILITY LAYOUT DESIGN	9

Need for Layout study, Factors influencing plant layout, Objectives of a good facility layout, Classification of layout, Layout procedure – Nadler's ideal system approach, Immer's basic steps, Apple's layout procedure, Reed's layout procedure –Layout planning – Systematic Layout Planning – Information gathering, flow analysis and activity analysis, relationship diagram, space requirements and availability, designing the layout. Utilities planning

UNIT III	COMPUTERISED LAY OUT PLANNING	9

Concepts, Designing process layout – CRAFT, ALDEP, CORELAP – Trends in computerized layout, Algorithms and models for Group Technology.

UNIT IV	DESIGNING PRODUCT LAYOUT	9

Line balancing - Objectives, Line balancing techniques – Largest Candidate rule- Kilbridge and Wester method- RPW method- COMSOAL.

UNIT V	MATERIAL HANDLING AND PACKAGING	9

Objectives and benefits of Material handling, Relationship between layout and Material handling, Principles of material handling, Unit load concept, Classification of material handling equipment's, Equipment selection, and packaging - Smart packaging solutions using AI and IoT for material handling.

	TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	analyse, design and apply layout principles for layout product, material handling and packaging.	Analysing (K4)

CO2	describe and determine the effect of product, process, and schedule design parameters on plant layout and materials handling systems design.	Understanding (K2)
CO3	develop and analyse plant layouts using manual and computer aided software methodologies.	Applying (K3)
CO4	identify and select various types of material handling equipment.	Understanding (K2)
CO5	design material handling systems for a variety of scenarios pertaining to manufacturing and service industry.	Analysing (K4)

TEXT BOOKS

1. Francis, R.L., and White, J.A, "Facilities layout and Location", Prentice Hall of India, 2002.
2. Facilities Planning, Tompkins, J.A., White, J.A., Bozer, Y.A., Tanchoco, J.M.A., John Wiley and Sons Inc., 4th Edition, 2010.

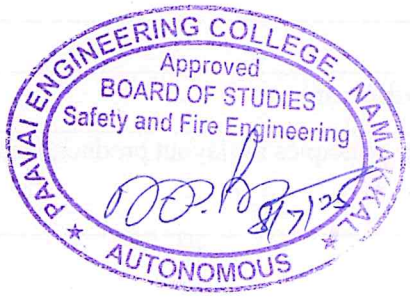
REFERENCES

1. James, Apple, "Material Handling System design", Ronald Press, 1980.
2. Krajewski, J. and Ritzman, "Operations Management – Strategy and Analysis", Addison Wesley publishing company, 5th Edition, 1999.
3. Pannerselvam.R, "Production and Operations Management", PHI, 2nd Edition, 2005
4. Tompkins, White et al., "Facilities planning", John Wiley & Sons, inc. 2003.

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	1	3	2
CO2	3	2	-	2	-	2	2	-	-	-	-	1	2	2
CO3	3	3	-	3	2	2	2	2	-	-	-	2	2	2
CO4	3	2	-	-	-	2	2	-	-	-	-	1	2	2
CO5	3	3	-	3	2	-	-	-	-	-	-	2	2	2



SF20452	SAFETY ASPECTS OF INTEGRATED PRODUCT DEVELOPMENT	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the global trends and development methodologies of various types of products and services
2	conceptualize, prototype and develop product management plan integrating the hardware, software, controls, electronics and mechanical systems
3	collect, analyze and arrive at requirements for new product development and convert them in to design specification
4	understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
5	develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I	FUNDAMENTALS OF PRODUCT DEVELOPMENT	9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT II	REQUIREMENTS AND SYSTEM DESIGN	9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III	DESIGN AND TESTING	9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation.

UNIT IV	SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT	9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal.

UNIT V	BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY	9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia The IPD Essentials - Introduction to Vertical Specific Product Development processes Manufacturing/Purchase and

Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.	
	TOTAL PERIODS:45
COURSE OUTCOMES	**BT MAPPED** (Highest level)
At the end of the course, the students will be able to	
CO1 define, formulate and analyze a problem	Analysing (K4)
CO2 solve specific problems independently or as part of a team	Understanding (K2)
CO3 gain knowledge of the Innovation & Product Development process in the Business Context	Applying (K3)
CO4 work independently as well as in teams	Understanding (K2)
CO5 manage a project from start to finish	Analysing (K4)

TEXT BOOKS

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005

REFERENCES

1. Hiriyappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	-	-	-	-	1	-	-	-	3	3	2
CO2	1	-	1	-	-	-	-	-	1	-	-	-	2	2
CO3	1	-	1	-	1	-	2	1	-	-	-	-	2	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	2	2
CO5	-	-	1	-	1	-	-	-	1	1	-	3	2	2

SF20453	SAFETY IN CONSTRUCTION INDUSTRY AND TOWN PLANNING	.3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	know the Basic terminology in safety, types of injuries
2	identify the accident patterns and safety methods by training procedure
3	know the effect of various hazards and select the suitable PPE
4	identify the safety procedures in material handling systems
5	know the basic laws and penalties for safety in construction industry

UNIT I	INTRODUCTION TO SAFETY AND ENVIRONMENT	9

Introduction to Construction Industry- Safety issues in construction- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry. Framing Contract conditions on safety, and related matters. Relevance of ergonomics in construction safety.

UNIT II	SAFETY TRAINING	9

Safety in various construction operations- Excavation- under- water works- under- pinning & shoring Ladders & Scaffolds- Tunneling- Blasting- Demolition- Pneumatic caissons- confined Space - Smart Sensors and AI for Monitoring Pneumatic Caisson and Confined Space Safety - Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.

UNIT III	PERSONAL PROTECTIVE EQUIPMENT AND WELFARE FACILITIES	9

Chemical substance- chemical and their risk and preventive measures. Hazards substances – AIDS - Noise and Vibration-Lighting-Exposure to heat and cold-Need of PPE-Head, Foot, Hand, Skin and Eye and Respiratory protection systems-safety harness.

UNIT IV	SAFETY POLICIES IN MATERIAL HANDLING SYSTEMS	9

Safety in construction equipment- Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers, Conveyors, Pneumatic and hydraulic tools in construction - Intelligent load monitoring systems in cranes and hoists powered by AI - Temporary power supply.

UNIT V	ENFORCEMENT OF HEALTH AND SAFETY LAWS	9

Contract Labor (R&A) Act and Central Rules: Definitions, Registration of Establishments, Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties, Rules regarding wages. Building and Other Construction Workers (RE&CS) Act, 1996 and Central Rules, .1998: Applicability, Administration, Registration, Welfare Board & Welfare Fund, Training of Building workers, General Safety, Health & Well fare provisions, Penalties.

		TOTAL PERIODS:45
COURSE OUTCOMES		**BT MAPPED** (Highest level)
At the end of the course, the students will be able to		
CO1	frame the various condition for safety and other related matters in construction industry	Applying (K3)

CO2	apply the safety operations under various construction works and explain about the codes utilized in construction industry.	Applying (K3)
CO3	select and use the proper material handling equipment and storage systems in construction industry to satisfy the safety.	Applying (K3)
CO4	apply the various safety policies in construction industry for proper utilization of material handling systems.	Applying (K)
CO5	describe the importance labor act and licensing of various work to ensure the safety of workers in construction industry.	Analysing (K4)

TEXT BOOKS

1. Safety, health and welfare on construction sites- A training manual- International Labour Office Geneva-1995
2. Principles of construction safety, "Allan St John holt, Sri Frank Lampl",-Blackwell science -2005.

REFERENCES

1. Safety and health in construction International Labour Office Geneva-1992
2. Safety manual for construction workers" Labour department Directorate of industrial safety and health"
3. Prasanna Chandra, (2017), Project Planning, Analysis, Selection, Implementation and Review, 8th Edition, McGraw-Hill, New Delhi.
4. Handbook of Temporary Structures in Construction- McGraw-Hill Education-2nd edition-2000

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	3	2	1	-	-	-	-	-	-
CO2	3	3	2	2	2	3	3	1	-	-	-	-	-	-
CO3	3	3	2	2	2	3	3	1	-	-	-	-	-	-
CO4	3	2	3	2	3	3	2	1	-	-	-	-	-	-
CO5	2	2	2	1	1	2	3	1	-	-	-	-	-	-

SF20454	SAFETY IN AUTOMOTIVE DESIGN AND CONTROL	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	reduce the occurrence of vehicle accidents and its consequences.
2	provide exposure to the students about safety and health provisions related to hazardous processes as laid out in factories act 1948.
3	familiarize students with powers of inspectorate of factories.
4	students to learn about environment act 1948 and rules framed under the act
5	provide wide exposure to the students about various legislations applicable to an industrial unit

UNIT I MOTOR VEHICLES RULES **9**

Types of automobiles. Limiting dimensions as per central motor vehicles rules. Engines – classification, construction, Materials of engine components. Prototype testing as per central motor vehicles rules. Fuel system – fuel tank, fuel filter, types of fuel system. carburetor – simple and modern, fuel injection system. Emission standards as per CMV rules.

UNIT II TRANSMISSION SYSTEM **9**

Necessity, Construction of differential systems, Axles, Types and Application-, 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, 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.

UNIT III ELECTRICAL SYSTEM **9**

Ignition Systems, Magnet ignition, Battery Ignition, Electronic Ignition, Merits and Demerits, Working, Self-Starter, Dynamo voltage regulator, Battery construction, operation and maintenance; pollution, Air-pollution, Euro norms, Pollution Control techniques.

UNIT IV LUBRICATION SYSTEM **9**

Types, Components, Lubricating oil, Cooling System, Detail of Components, Study of Systems, Types, Miscellaneous, Special Gadgets and accessories for Fire Fighting vehicles, Automobile Accidents, CMV Rules regarding safety devices for Drivers, Passengers, Fire fighting vehicles & Appliances. Construction & operation of fire fighting vehicles & appliances, Construction & Operation of Fire boats & other Water borne applications, Rules & regulations of RTO; Laboratory testing of vehicles; Road testing of vehicles. Automobile safety devices.

UNIT V POLLUTION CONTROL IN PROCESS INDUSTRIES **9**

Pollution control in process industries like cement, paper, and petroleum, petroleum products textile tanneries-thermal Power plants – dying and pigment industries - eco-friendly energy.

TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	reduce the occurrence of vehicle accidents and its consequences.	Applying (K3)
CO2	provide exposure to the students about safety and health provisions related to Hazardous Processes as laid Out in Factories act 1948.	Understanding (K2)
CO3	familiarize students with powers of inspectorate of factories.	Understanding (K2)
CO4	learn about Environment act 1948 and rules framed under the act	Understanding (K2)
CO5	provide wide exposure to the students about various legislations applicable To an industrial Unit	Applying (K3)

TEXT BOOKS

1. Purandare D.D &Abhay D. Purandare, "Hand book on Industrial Fire Safety" P & A publications, New Delhi, 2006.
2. Jain V K "Fire Safety in Building" New Age International 1996.

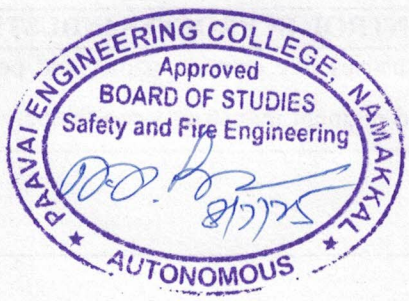
REFERENCES

1. Subramanian's., "The Factories Act 1948 with Tamilnadu factories rules 1950", Madras Book Agency, Chennai, 21st edition., 2000.
2. "The Environment Act (Protection) 1986 with allied rules", Law Publishers (India) Pvt. Ltd., Allahabad.
3. "Water (Prevention and control of pollution) act 1974", Law publishers (India) Pvt. Ltd., Allahabad.
4. "Air (Prevention and control of pollution) act 1981", Law Publishers (India) Pvt. Ltd., Allahabad

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	2	-	-	-	2	-	-	-	2	2	3
CO2	1	2	3	2	-	-	-	2	-	-	-	2	2	3
CO3	1	2	3	2	-	-	-	2	-	-	-	2	2	3
CO4	1	2	3	2	-	-	-	2	-	-	-	2	2	3
CO5	1	2	3	2	-	-	-	2	-	-	-	2	2	3



SF20903	RESCUE EQUIPMENT AND TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	demonstrate theoretical knowledge in management course
2	describe the hydraulic and pneumatic operate rescue technique and its equipment's.
3	reduce damage to buildings, stock, and equipment. Protect the environment and the community
4	information on rescue scene organization and management
5	optional information on litter walkouts and ladder system used in low angle rope rescue operation

UNIT I	GENERAL INTRODUCTION RESCUE EQUIPMENT	9

Emergency Rescue Tender, Water Tender, Foam tender, Multipurpose Tender Hydraulic Platform, Turn Table Ladder, Canteen Van and Ambulance; Fire Extinguishers: - Their types and Applications. Rescue by Ordinary Means.

UNIT II	HYDRAULICALLY AND PNEUMATICALLY OPERATED TOOLS AND EQUIPMENTS	9

Hydraulic Jack, Hydraulic Cutter, Hydraulic Expander. Air Lifting Bags, Electric Power Tools: - Electric Cutter, Electric Saw, Chain Saw etc. Small Gears: - Their types, Applications and working principal Ladders: Constructional features, their types, Material and applications Ropes: their types, material and applications.

UNIT III	DIFFERENT TYPES OF KNOTS, HITCHES AND THEIR APPLICATIONS IN EMERGENCY	9

Fireman carry, two men carry, three man carry, four man carry, chair carry, stretcher carry and different types of Drags. Rescue problems and their remedies, Rescue from High rise buildings, Rescue from major disasters Earthquake, Flood, Drought, Tsunami etc. Rescue from Fire incident.

UNIT IV	RESPIRATORY EQUIPMENTS	9

Rope, Rope Materials, Rope Braiding, Webbing, Carabiners, Swivels, Personal Protective Equipment, Composition of Air, Breathing, Breathing Rate, Calculation of the capacity & time duration of the B.A. Set. Artificial Respiration and their techniques, Renunciator, B.A. Set: Their types, Constructional features, Working Principal and Applications, Gas Masks: Their types, Constructional features, Working Principal and Applications.

UNIT V	RESCUE SYSTEM IN SAFETY	9

Anchor Systems- Rappelling, Ascending- Purcell Prusiks - Yosemite Ascending System – Rescue Lowering Systems- Edge Management and Edge Protection- Mechanical Advantage, Knot Passing Technique – Litter Lower/Raise Technique – Medical Considerations.

	TOTAL PERIODS:45
COURSE OUTCOMES	**BT MAPPED** (Highest level)
At the end of the course, the students will be able to	
CO1 understanding of the care, strengths and weaknesses of rescue equipment.	Analysing (K1)

CO2	proficiency in tying the basic rescue knots used with climbing rope and sling material.	Understanding (K2)
CO3	competence in executing a counterbalance descent in a vertical environment and Competence in executing a counterbalance rise in a vertical environment	Applying (K3)
CO4	proficiency in raising a climber to a belay stance using select mechanical advantage systems	Understanding (K4)
CO5	understanding of one's strengths and limitations as a climber in a technical rescue environment	Analysing (K3)

TEXT BOOKS

1. Safety And Technical Rescue Equipment, City Of Chicago Department Of Procurement Services, Rfq Number: 4682
2. National Park Service Technical Rescue Handbook, Eleventh Edition. August 2014 Published by the U.S. Department of the Interior, National Park Service. Tenth edition published 2005

REFERENCES

1. Personal Protective Equipment, Occupational Safety and Health Administration, OSHA 3151- 12R, 2004
2. Manual of fireman ship Incidents involving aircraft, shipping and railways HMSO publishing center, third impression 2010.
3. Rescue Service Manual by HMSO, Rescue Service Manual by HMSO,2008, published by TSO
4. Rescue - Civil defense handbook by HMSO

CO - PO MAPPING

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COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	2	3	-	1	-	-	2	1	1	-	1
CO2	2	1	-	2	-	-	-	1	1	-	2	1	2	1
CO3	-	2	1	-	2	1	1	-	-	1	-	-	2	-
CO4	1	-	1	1	-	-	2	-	2	-	3	-	1	1
CO5	-	1	-	-	-	1	1	-	1	2	-	-	1	-

SF20904	FIRE SAFETY ENGINEERING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	acquire knowledge of Fire and Safety Studies .
2	learn about the effect of fire on materials used for construction, the method of test for non- combustibility and fire resistance
3	learn about fire area, fire stopped areas and different types of fire-resistant doors
4	learn about the method of fire protection of structural members and their repair due to fire damage.
5	develop safety professionals for both technical and management through systematic and quality-based study programmes.

UNIT I	INHERENT SAFETY CONCEPTS	9

Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings. Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behavior of non-structural materials on fire- plastics, glass, textile fibres and other house hold materials

UNIT II	PLANT LOCATIONS	9

Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements- standard heating condition, Indian standard test method, performance criteria.

UNIT III	WORKING CONDITIONS	9

Fire separation between building- principles of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors

UNIT IV	FIRE SEVERITY AND REPAIR TECHNIQUES	9

Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures- Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V	WORKING AT HEIGHTS	9

Safe Access - Requirement for Safe Work Platforms- Stairways - Gangways and Ramps-Fall Prevention & Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs - Work Permit Systems-Accident Case Studies.

TOTAL PERIODS:45

COURSE OUTCOMES		BT MAPPED (Highest level)
At the end of the course, the students will be able to		
CO1	understand the effect of fire on materials used for construction	Analysing (K4)
CO2	understand the method of test for non-combustibility and fire resistance	Applying (K3)
CO3	understand the design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread.	Analysing (K4)
CO4	decide the method of fire protection to rcc, steel, and wooden structural elements and their repair methods if damaged due to fire.	Evaluating (K5)
CO5	describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.	Understanding (K2)

TEXT BOOKS

1. Roytman, M. Y,"Principles of fire safety standards for building construction". Amerind Publishing Co. Pvt. Ltd., New Delhi,1975
2. John A. Purkiss,"Fire safety engineering design of structures" (2nd edn.), Butterworth Heinemann, Oxford, UK,2009.

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1. Smith, E.E. and Harmathy, T.Z. (Editors),"Design of buildings for fire safety". ASTM Special Publication 685, American Society for Testing and Materials, Boston, U.S.A,2005.
2. Butcher, E. G. and Parnell, A. C, "Designing of fire safety". JohnWiley and Sons Ltd., New York, U.S.A.2006.
3. Jain, V.K,"Fire safety in buildings" (2nd edn.). New Age International(P) Ltd., New Delhi,2010. 4. Hazop&Hazan,"Identifying and Assessing Process Industry Hazards", Fourth Edition ,2011.
4. Frank R. Spellman, Nancy E. Whiting,"The Handbook of Safety Engineering: Principles and Applications", 2009.

CO - PO MAPPING

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CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	2	-	-	-	3	-	-	1	-	-	-	-
CO4	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO5	1	-	2	-	-	1	1	1	-	-	-	1	-	-