FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Automobile Engineering)**

Semester: **VIII**

Course Code: **202010805**

Course Title: **Industrial and Road Safety**

Course Group: **Professional Elective Course-VI**

Course Objectives: The course covers the fundamentals of safety aspects in Industry and Road usage. The student will learn different hazard identification procedures and methodologies for hazard analysis. The students also will be exposed to the safety management aspects as well as safety practices in industries. The students will also be imparted with the knowledge of risk factors in a road accident and types of injuries. Moreover, they will be sensitized about the traffic control, safety features and equipment in a vehicle design and driver training.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	50 / 18	25 /9	50 / 17	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Industrial Safety** Background, general terms in risk analysis and safety. Typical hazards and experiences from worldwide accidents, and insurance companies. Accident indices. Fire and explosion hazards, Dow's fire and explosion index.	05
2	**Hazard Analysis** Hazards identification procedures for plants and machinery: Preliminary hazard analysis (PHA), Fault Hazard Analysis (FHA), Hazard and operability (HAZOP), What if, Check lists, Failure mode and effects analysis (FMEA),Failure mode, effects and criticality analysis (FMECA), etc. FTA (Fault tree analysis), ETA (Event tree analysis), and CCA (Cause consequence analysis), Bow-Tie and quantitative risk assessment (QRA), Human error analysis and safety.	11

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3	**Safety management and practices** Elements of Safety Programming, Safety Management, Safety Procedures, Arrangements and Performance Measures, Education, Training and Development in Safety. The Safety Professional, Occupational Health and Industrial Hygiene, Emergency Preparedness and Response, Plant Layout and Design, Ergonomic Considerations for Plant Design & Layout, Control of Heat Exposures, Classification of Fire and Extinguishers, Design for Fire Safety, Fire Prevention and Protection Systems, Requirements of Machine Guarding, Need of Safety in Material Handling, Working at Height, Personal Protective Equipment, Selection and Classification, Need of the First Aid, General Principles for Rendering First Aid, OSHAS 18001 and OSHMS.	**11**
4	**Introduction to Road Safety** The scope of the road accident problem worldwide, A survey of some risk factors for accident involvement, A survey of risk factors for injury severity, Assessing the relative importance of risk factors, Safe infrastructure and systems, The energy control approach and Haddon's ten strategies, Haddon's matrix.	**05**

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5	**Road Safety Measures** **a. Traffic Control** Access control, Priority control, Yield signs at junctions. , Stop signs at junctions , Traffic signal control at junctions , Signalized pedestrian crossings, Speed limits, Speed-reducing devices , Road markings, Traffic control for pedestrians, Stopping and parking control, One-way streets, Reversible traffic lanes, Bus lanes and bus stop design, Dynamic route guidance, Variable message, Protecting railway–highway level crossings, Environmental zones. **b. Vehicle Design and Protective Devices for Road Safety** Introduction and overview of 29 measures, Tyre tread depth , Studded tyres , Antilock braking systems and disc brakes, High-mounted stop lamps, Daytime running lights for cars, Daytime running lights for mopeds and motorcycles, Improving vehicle headlights, Reflective materials and protective clothing, Steering, suspension and vehicle stability, Bicycle helmets, Motorcycle helmets, Seat belts in cars, Child restraints, Airbags in cars, Seat belts in buses and trucks , Vehicle crashworthiness, Driving controls and instruments, Intelligent cruise control, Regulating vehicle mass (weight), Regulating automobile engine capacity (motor power) and top speed, Regulating engine capacity (motor power) of mopeds and motorcycles, Under-run guards on heavy vehicles, Safety equipment on heavy vehicles, Moped and motorcycle equipment, Bicycle safety equipment, Safety standards for trailers and caravans , Fire safety standards, Hazardous goods regulations , Electronic stability control. **c. Driver Training and Regulation of Professional Drivers** Introduction and overview of 12 measures, Driving license age limits, Health requirements for drivers, Driver performance standards, Basic driver training, The driving test, Safety standards for emergency driving, Safety standards for school transport, Defensive driving techniques.	**13**

List of Practicals / Tutorials:

1	Identifying hazards and estimating accident indices
2	Fire and explosion hazards and their estimation using Dow's fire and explosion index guide
3	Hazard identification, assessment and recommendation for industrial situations and cases involving well known and well-practiced procedures
4	Hazard analysis and Risk Assessment using FTA
5	Hazard analysis and Risk Assessment using ETA

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6	Hazard analysis and Risk Assessment using CCA
7	Performance of Bow-tie analysis
8	Performance of quantitative risk assessment
9	Identification of blind spots
10	Case study on road accidents

Reference Books:

1	Loss prevention in process industries by Lees, F.P., Vols.1-4, Elsevier Butterworth - Heinemann, Oxford, UK, 2005.
2	Industrial Safety and Maintenance by Deshmukh, Tata McGraw Hill
3	Dow's Fire and Explosion Index - Hazard Classification Guide, 5th Edition, A.I. Ch. E., New York, 1981
4	Probabilistic Risk Assessment and Management for Engineers and Scientists, by Hiromitsu Kumamoto and E. J. Henley, 2nd Edition, IEEE Press.
5	Fundamentals of industrial safety and health by K. U. Mistry, Siddharth Prakashan
6	The Handbook of Road Safety Measures, by Rune Elvik, Alena Høye, Truls Vaa, Michael Sørensen, 2nd Edition, Emerald Publications
7	Transport Planning and Traffic Safety by Geetam Tiwari and Dinesh Mohan, CRC Press
8	Motor Vehicle Act - Govt. of India Publications.

Supplementary learning Material:	
1	NPTEL Resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Industry/Field Visit
- Interactive Methods

Internal Evaluation :

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The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
25%	25%	30%	15%	5%	0 %	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.No	Course Outcome Statements	%weightage
CO-1	Understand basic concepts of Industrial safety	**12**
CO-2	Learning different techniques of hazard analysis	**24**
CO-3	Understanding the essentials of safety management and practices	**24**
CO-4	Learning the fundamentals of road safety	**12**
CO-5	Understanding impact of traffic control, vehicle design, and driver training for road safety.	**28**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027

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