SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Mechanical Engineering Department

B. Tech. Semester VII

Course Name: **Safety and Maintenance Engineering** **Course Code: BTME14717**

Type of course: **Professional Elective Courses**

Prerequisite: None

Rationale of course: The course is prepared to provide basic understanding of importance of safety, maintenance and types of maintenance required in industries. Students will learn maintenance policy, strategy, planning, different failure, maintenance required to prevent failure, replacement and safety factors requires in Industry.

Teaching and Examination Scheme:

Teaching scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
3	0	0	3	60	25	15	00	00	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Introduction**: Introduction, Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity, Sound Maintenance systems – Reliability and machine availability, Equipment Life cycle, Measures for Maintenance Performance: Equipment breakdowns, Mean Time Between Failures and Repair, Factors of availability, Maintenance organization and economics Productivity; Quality and Quality circle in Maintenance, engineering Reliability, Reliability Assurance through Redundancy, Maintainability and maintainability improvement, operating life cycle, Failure data analysis, failure rate curve, hazard models.	**7**	**15 %**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
2	**Maintenance Strategies:** Importance of maintenance, Objectives, duties, functions and responsibilities of maintenance engineering department, type of maintenance, Break down maintenance, planned maintenance, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero-break down, preventive inspection of equipment used in emergency, Scientific maintenance ,Organization and structure of maintenance systems, Maintenance Policies and Planning: Maintenance strategies, advantages and disadvantages of each strategy	**9**	**20 %**
3	**Replacement Planning &Maintain or Replace Decision:** Economic models, block replacement policy, age replacement policy, and replacement policies to minimize downtime Replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement and replacement in anticipation of failure. Break down maintenance planning.	**4**	**9 %**
4	**Safety In Engineering Industry:** Introduction - definitions - classification of engineering industry - different process in engineering industry. Fundamental of Industrial Safety, Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage, Hazard and Operability Study (HAZOP), disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. Care and maintenance of common elements used in material handling equipment like rope chains slings, hooks, clamps. General safety consideration in material	**16**	**36 %**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
	handling - manual and mechanical handling. Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents. Types and Categorization of Accidents. Accidents preventions, Safety Training. Onsite offsite Emergency Plans, Job Safety Analysis (JSA), Safety Survey, Reporting of accidents, and dangerous occurrence.		
5	**Maintenance Management:** Factors involved in effective planning of maintenance work, Various methods of scheduling work, Categorization of plant/equipment for the purpose of priorities. Short term and Long Term Maintenance Plans: Major repair, Capital Repair, and Annual Overhauls, Renovation, Revamping, and Modernization economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management .**Maintenance Organization:** Computer applications in maintenance management, automatic chalk out equipment kits capabilities and limitations, Management information system for maintenance	**9**	**20 %**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**30**	**30**	**10**	**10**	**5**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**
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.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication Year	Publication Edition
1	Reliability and Maintenance Engineering	Alkesh Manna	Dreamtech Press	2020	--
2	Maintenance Engineering and Management	M.I.Khan	New Age International Private Limited	2017	--
3	Industrial Safety Handbook	William Handley	McGraw-Hill Companies;	1977	2nd
4	Industrial Safety	Roland P Blake	Prentice Hall	2000	3rd
5	Industrial Maintenance Management	Srivastava S.B.	I K International Publishing House	2012	1st

Course Outcomes (COs):

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Infer the concept of maintenance and terms related to maintenance.	15
CO-2	Interpret different kinds of Maintenance required and their procedures.	20
CO-3	Write Replacement planning in anticipation of failures.	9
CO-4	Apply knowledge of different kinds of Safety procedures followed in industries and occupational diseases.	36
CO-5	Analyze different maintenance techniques and maintenance management.	20

Mapping of COs with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO-1	3	0	0	0	0	1	0	3	1	0	1	2	3	0	1
CO-2	3	1	0	1	0	1	1	1	1	1	1	1	3	1	1
CO-3	3	1	1	1	1	1	1	1	1	1	1	1	3	1	1
CO-4	3	1	1	1	1	1	2	1	1	1	1	1	3	1	1
CO-5	3	1	1	1	2	1	1	1	1	1	1	1	3	1	1
Rationale*	**15**	**4**	**3**	**4**	**4**	**5**	**5**	**7**	**5**	**4**	**5**	**6**	**15**	**4**	**5**

***Rationale - Mapping of COs with POs and COs with PSOs:**

It states that the course will develop Engineering Knowledge, addresses societal, health, safety, legal and cultural issues, professional engineering solution, apply ethical principles and commit it. it focuses on individual and team work and better communication. Course also focuses on knowledge of Safety and Maintenance Engineering.

This course highly maps with PO 1 and PSO 1. It states that the course will develop Engineering knowledge. This Course also focuses on Problem analysis, Design / development of solutions, Conduct investigations of complex problems, Modern tool usage, The engineer and society, Environment and sustainability, Ethics, Individual and teamwork, Communication, Project management and finance, Life-long learning.

Assignments to be given as per the requirement of the course.

List of Open learning website:

1 https://nptel.ac.in/courses/110105094

List of Open Source Software: Nil