JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

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JECRC Campus ,Shri Ram ki Nangal, Via-Vatika ,Tonk Road, Jaipur

Department of Mechanical Engineering

Name of Subject: Maintenance Management [MM]
Subject Code: 8MI6-60.2

Year: 4th Year, VIIIth-Semester

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Department of Mechanical Engineering

Vision and Mission of Institute:

Vision: To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission:

M1: Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.

M2: Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.

M3: Offer opportunities for interaction between academia and industry.

M4: Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

Vision and Mission of Department:

Vision: The Mechanical Engineering Department strives to be recognized globally for outcome based technical knowledge and to produce quality human resource, who can manage the advance technologies and contribute to society.

Mission:

M1: To impart quality technical knowledge to the learners to make them globally competitive mechanical engineers.

M2: To provide the learners ethical guidelines along with excellent academic environment for a long productive career.

M3: To promote industry-institute relationship.

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Department of Mechanical Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: To equip graduates with a strong foundation in engineering sciences, with an emphasis on mechanical engineering principles, enabling them to analyze, design, and solve real-world engineering challenges.

PEO2: To prepare graduates with sound scientific and engineering fundamentals to innovate and deliver effective solutions addressing practical challenges in mechanical engineering

PEO3: To inculcate in graduates a professional and ethical attitude, effective communication and teamwork skills, a multidisciplinary approach, entrepreneurial mindset, and the ability to connect engineering solutions with societal and environmental concerns.

PEO4: To provide students with an academic environment that fosters excellence, leadership, adherence to ethical standards, and encourages self-motivated lifelong learning essential for a successful professional career in mechanical

PEO5: To prepare students to excel in industry and higher education by providing quality education grounded in strong technical knowledge and high moral values

Program Specific Outcomes (PSOs)

PSO1: Graduates will be able to design, analyze, and fabricate electric and hybrid vehicles using modern engineering tools and sustainable practices.

PSO2: Graduates will be able to apply design principles and computational techniques, including programming and data structures, to analyze and solve mechanical engineering problems.

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Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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SYLLABUS

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Open Electives Syllabus

B. Tech.: IV Year- VII & VIII Semester

8MI6-60.2: Maintenance Management

Credit : 3 **Max. Marks: 100(IA:30, ETE:70)**

3L+0T+0P **End Term Exam : 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction: General objectives, Functions; Organization and administration of maintenance systems; Requirements, Concepts and structure of suitable organizations for maintenance systems	4
3	Failure Analysis: Analysis for source identification, classification land selectivity of failure; Statistical and reliability concepts and models for failure analysis	4
4	Classification of maintenance systems; Basis and models for various maintenance systems	4
5	Cost management for maintenance: cost estimates- recording, summarizing and distributing cost data, maintenance budget	4
6	Decision models for maintenance planning; Operation and control, optimum level of maintenance; replacement aspects of breakdown and preventive types, group and individual types, obsolete facility, deteriorating and completely failing facilities	4
7	Replacement vs. reconditioning, economics of overhaul, addition replacement model-additive damage case, zero memory case, partially observed situation, planning horizon procedure	3
8	Spare planning and control: static spares, insurance spares with and without salvage value, low moving spares; man power planning-crew size , allocation etc. stand by machines	4
9	economical and operational aspects; scheduling planning of activities, monitoring and updating, resource allocation, Assigning priorities	4
10	Other relevant topics: work measurement for maintenance, maintenance control indices, maintenance service contract, preventive maintenance management-guidelines, procedure, general management of lubrication system,	4
11	Organizing preventive maintenance program using vibration signature analysis-some basic ideas, management of records for maintenance, computerization of maintenance activities, major plant shut-down procedures	3
	Total	**39**

REFERENCE BOOKS (MSE)

TEXT BOOK				
S. No.	**Book Title**	**Author(s)**	**Publisher**	**Latest/Recommended Edition (Year)**
1	Maintenance Engineering and Management	R. C. Mishra & K. Pathak	PHI Learning Pvt. Ltd., New Delhi	3rd Edition (2019)
REFERENCE BOOK				
1	Maintenance Engineering Handbook	Keith Mobley (Ed.)	McGraw-Hill Education	8th Edition (2019)
2	Engineering Maintenance: A Modern Approach	B. S. Dhillon	CRC Press, Taylor & Francis	2002
3	Reliability, Maintenance and Safety Engineering	Amit Kumar Gupta	Laxmi Publications (P) Ltd., New Delhi	2nd Edition (2017)
4	Maintenance Planning and Scheduling Handbook	Richard D. Palmer	McGraw-Hill Education	3rd Edition (2012)
5	Maintenance Engineering and Management	V. S. Narayan	Prentice Hall of India (PHI Learning)	1st Edition (2004)

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COURSE OUTCOME

Subject: Maintenance Management [8MI6-60.2]

CO1: Explain the concepts, objectives, and types of maintenance, including preventive, predictive, and corrective approaches.
CO2: Illustrate maintenance planning, scheduling, and documentation methods to ensure effective utilization of resources.
CO3: Apply condition monitoring techniques for identifying machine health.
CO4: Analyze equipment failure modes, reliability parameters, and root cause analysis for decision making.
CO5: Evaluate various maintenance strategies in terms of cost, availability, and productivity.
CO6: Develop a comprehensive maintenance plan for engineering applications.

CO-PO MAPPING

Subject: Maintenance Management [8MI6-60.2]

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	1	1	2	2	1	1	2	2
CO2	3	3	3	2	2	2	1	2	2	2	2	3	3
CO3	3	3	3	3	2	2	2	2	2	2	2	3	3
CO4	3	3	3	3	2	2	2	2	2	3	2	3	3
CO5	3	3	3	3	2	2	2	3	3	2	2	3	3
CO6	3	3	3	3	2	2	2	3	3	2	2	3	3

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Course Plan

Name of the Course : **Maintenance Management**
Code of the course : **8MI6-60.2**
Name of Faculty : **Prof. (Dr.) Fauzia Siddiqui**

Course Outcome

CO1: Explain the concepts, objectives, and types of maintenance, including preventive, predictive, and corrective approaches.
CO2: Illustrate maintenance planning, scheduling, and documentation methods to ensure effective utilization of resources.
CO3: Apply condition monitoring techniques for identifying machine health.
CO4: Analyze equipment failure modes, reliability parameters, and root cause analysis for decision making.
CO5: Evaluate various maintenance strategies in terms of cost, availability, and productivity.
CO6: Develop a comprehensive maintenance plan for engineering applications.

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Unit	Topic	Lec. No.	CO	Specific Objectives	Expected Outcomes	Primary Reference (Chapter & Page No.) (Maintenance Engineering and Management, R.C. Mishra & K. Pathak, PHI Learning Pvt. Ltd., 3rd Edition, 2019.)
Intro	Course Introduction, Syllabus & COs	1	CO1	Introduce course objectives and evaluation scheme.	Explain course outcomes and importance of maintenance.	Ch.1, pp.1–6
I	Introduction to Maintenance	2	CO1	Explain maintenance concepts and objectives.	Define maintenance and its importance.	Ch.1, pp.7–12
I	Functions and Objectives of Maintenance	3	CO1	Discuss functions of maintenance.	Describe maintenance objectives.	Ch.1, pp.13–18
I	Types of Maintenance	4	CO1	Explain breakdown, preventive and predictive maintenance.	Differentiate maintenance strategies.	Ch.1, pp.19–28
I	Corrective & Routine Maintenance	5	CO1	Describe corrective and routine maintenance.	Select appropriate maintenance type.	Ch.1, pp.29–36
I	Maintenance	6	CO1	Explain	Describe	Ch.2, pp.37–46

	Organization			maintenance organization structure.	departmental responsibilities .	
I	Maintenance Planning	7	CO1	Explain planning activities.	Prepare maintenance plans.	Ch.2, pp.47–56
I	Maintenance Scheduling	8	CO2	Introduce scheduling techniques.	Develop maintenance schedules.	Ch.2, pp.57–66
II	Reliability Engineering	9	CO2	Explain reliability concepts.	Define reliability and failure rate.	Ch.3, pp.67–76
II	Reliability Functions	10	CO2	Discuss reliability functions.	Calculate reliability values.	Ch.3, pp.77–86
II	Failure Analysis	11	CO2	Explain failure mechanisms.	Identify failure causes.	Ch.3, pp.87–96
II	MTBF & MTTR	12	CO2	Introduce reliability indices.	Calculate MTBF and MTTR.	Ch.3, pp.97–104
II	Maintainability	13	CO2	Explain maintainability concepts.	Evaluate maintainability .	Ch.4, pp.105–112
II	Availability Analysis	14	CO2	Discuss availability concepts.	Determine system availability.	Ch.4, pp.113–120
II	Replacement Policies	15	CO3	Explain replacement decisions.	Apply replacement policies.	Ch.5, pp.121–132
II	Group Replacement	16	CO3	Explain group replacement model.	Solve replacement problems.	Ch.5, pp.133–142
III	Preventive Maintenance	17	CO3	Explain preventive maintenance techniques.	Prepare preventive maintenance schedules.	Ch.6, pp.143–154
III	Predictive Maintenance	18	CO3	Introduce predictive maintenance.	Differentiate predictive methods.	Ch.6, pp.155–164
III	Condition Monitoring	19	CO3	Explain condition monitoring methods.	Select monitoring techniques.	Ch.6, pp.165–174
III	Vibration Monitoring	20	CO3	Explain vibration analysis.	Interpret vibration data.	Ch.6, pp.175–184
III	Lubrication Management	21	CO3	Explain lubrication practices.	Select suitable lubricants.	Ch.6, pp.185–194
III	Oil Analysis	22	CO4	Explain oil	Assess	Ch.7, pp.195–202

				analysis methods.	lubricant condition.	
III	Thermography	23	CO4	Introduce thermal inspection.	Detect thermal faults.	Ch.7, pp.203–210
III	NDT Techniques	24	CO4	Explain non-destructive testing.	Select NDT methods.	Ch.7, pp.211–220
IV	Maintenance Cost	25	CO4	Explain maintenance cost elements.	Estimate maintenance cost.	Ch.8, pp.221–230
IV	Cost Control	26	CO4	Discuss cost reduction techniques.	Apply maintenance cost control.	Ch.8, pp.231–238
IV	Spare Parts Management	27	CO4	Explain spare parts control.	Manage spare inventory.	Ch.9, pp.239–248
IV	ABC & VED Analysis	28	CO4	Explain inventory classification.	Classify maintenance inventory.	Ch.9, pp.249–258
IV	EOQ for Spare Parts	29	CO5	Explain EOQ concept.	Calculate economic order quantity.	Ch.9, pp.259–268
IV	Shutdown Maintenance	30	CO5	Explain shutdown planning.	Prepare shutdown schedules.	Ch.10, pp.269–278
IV	Total Productive Maintenance (TPM)	31	CO5	Explain TPM concepts.	Describe TPM pillars.	Ch.10, pp.279–288
IV	Overall Equipment Effectiveness (OEE)	32	CO5	Explain OEE calculation.	Evaluate equipment effectiveness.	Ch.10, pp.289–298
V	Computerized Maintenance Management System (CMMS)	33	CO6	Introduce CMMS.	Explain CMMS applications.	Ch.11, pp.299–308
V	Maintenance Information System	34	CO6	Explain maintenance database.	Manage maintenance records.	Ch.11, pp.309–318
V	Root Cause Failure Analysis	35	CO6	Explain RCFA methodology.	Identify root causes.	Ch.12, pp.319–328
V	Failure Mode & Effects Analysis (FMEA)	36	CO6	Explain FMEA procedure.	Perform FMEA analysis.	Ch.12, pp.329–338
V	Reliability	37	CO6	Explain RCM	Apply RCM	Ch.13, pp.339–348

	Centered Maintenance (RCM)			concepts.	principles.	
V	Risk-Based Maintenance	38	CO6	Explain RBM methodology.	Assess maintenance risks.	Ch.13, pp.349–358
V	Industrial Case Studies	39	CO6	Discuss industrial maintenance practices.	Analyze real industrial cases.	Ch.13, pp.359–366
V	Course Review & CO Assessment	40	CO6	Review complete syllabus and solve case studies.	Integrate maintenance management concepts.	Ch.1–13, pp.1–366

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REFERENCE BOOKS

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