



Course Specification

DIPLOMA

Course Title: Maintenance

Course Code: APRT1203

Program: Renewable energy technologies

Department: Diploma Department

College: The Applied College

Institution: Umm Al-Qura University

Version: 1

Last Revision Date: 10 February 2025



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A. General information about the course:

1. Course Identification

1. Credit hours: (2)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (4th Level/ 2nd Year)

4. Course General Description:

1. Course Description

This maintenance course provides foundational knowledge and hands-on practice in essential maintenance tasks, including preventive scheduling, troubleshooting, and safe operating procedures. Students will develop technical expertise while upholding integrity, quality, and respect for safety protocols. Emphasizing autonomy and accountability, the course prepares learners to take ownership of their work, make informed decisions, and contribute effectively to maintenance operations.

5. Pre-requirements for this course (if any):

6. Co-requisites for this course (if any):

7. Course Main Objective(s):



Course Main Objective

The main objectives are as follows:

1. To explain maintenance objectives and functions, factors influencing Plant Availability, Need for maintenance plan and organization, Functions of maintenance control and determine Failure probability, Survival probability and Age specific failure rates of equipment and components.
2. To determine the optimal overhaul/repair/replacement maintenance policy for equipment subject to breakdown and to determine optimal interval between preventive replacements for individual and group replacement of equipment.
3. To explain different maintenance systems and the steps involved in establishing a maintenance plan and designing a technically sound preventive maintenance and lubrication program.
4. To determine the optimal inspection frequency for maximization of profit and minimization of downtime and the critical path using CPM and PERT.
5. To explain the NUCREC method of prioritizing maintenance work, Classification of spares, Costs associated with spares inventory, EOQ computation and MUSIC - 3D approach to spares management, to determine the optimal number of spars to satisfy given service level and to apply simulation technique for spares inventory.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	2	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/ <u>Studio</u>	
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		30



B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Explain maintenance objectives and functions, factors influencing Plant Availability, Need for maintenance plan and organization, Functions of maintenance control and determine Failure probability, Survival probability and Age specific failure rates of equipments and components.	K1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
1.2	Determine the optimal overhaul/repair/replacement maintenance policy for equipment subject to breakdown and optimal interval between preventive replacements for individual and group replacement of equipment.	K2		
1.3	Explain different maintenance systems and the steps involved in establishing a maintenance plan and designing a technically sound preventive maintenance and lubrication program.	K3		
1.4	Determine the optimal inspection frequency for maximization of profit and minimization of down time and the	K4		



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	critical path using CPM and PERT.			
2.0	Skills			
2.1	Plan and implement routine checks to avoid breakdowns, and utilize predictive tools (like vibration analysis).	S2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.2	Employ systematic methods (e.g., Root Cause Analysis) to identify, diagnose, and resolve equipment issues efficiently.	S3	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.3	Follow workplace safety regulations, use protective gear, and apply hazard-control procedures (like lockout/tagout).	S4		
2.4	Understand basic mechanical and electrical concepts, master common tools and instruments, and perform essential maintenance tasks (e.g., lubrication, alignment).	S5		
3.0	Values, autonomy, and responsibility			
3.1	Commit to high standards and continuous self-improvement.	V1	Minor project and report presentation	Minor project report and presentation
3.2	Prioritize safe practices and treat others and equipment responsibly.	V2		





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.3	Take initiative and ownership of your actions and learning.	V4		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to Tribology: Properties of oils and equation of flow: Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, idealized full journal bearings.	6
2	Mechanism of Pressure Development in An Oil Film: Reynold's investigations, Reynold's equation in two dimensions - Partial journal bearings, end leakages in journal bearing, numerical problems. Slider / Pad Bearing with a Fixed and Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, influence of end leakage, numerical examples.	6
3	Oil Flow and Thermal Equilibrium of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings, Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.	6
4	Bearing Materials: Commonly used bearings materials, properties of typical bearing materials, Wear: Classification of wear, wear of polymers, wear of ceramic materials, wear measurements, effect of speed, temperature and pressure.	6
5	Behavior of Tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering.	6
Total		30



D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1. 1	Quizzes and Exercise	3-8	%10
2. 2	Report & Presentation	3-8	%20
3. 3	Mid-term	9	%20
4	Final exam	17/18	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<ul style="list-style-type: none"> Basu S K., Sengupta A N., Ahuja B. B., Fundamentals of Tribiology PHI 2006. Mujumdar B. C., Introduction to Tribology Bearings, S. Chand company Pvt. Ltd 2008.
Supportive References	<ol style="list-style-type: none"> Fuller, D., Theory and Practice of Lubrication for Engineers, New York Company 1998. Principles and Applications of Tribiology, Moore, Pergamaon press 1998. Srivastava S., Tribiology in Industries, S Chand and Company limited, Delhi 2002. Redzimovskay E I., Lubrication of bearings – Theoretical Principles and Design, Oxford press company 2000.
Electronic Materials	All the lecture notes
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	



F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty	Direct (project, HW, Quiz, midterm and final exam)
Effectiveness of Students assessment	Students	Indirect (Student Survey)
Quality of learning resources	Program Coordinator	Direct analysis
The extent to which CLOs have been achieved	Program Coordinator	Direct analysis
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
REFERENCE NO.	851141114462/190394
DATE	22/11/1446

