

**MAINTENANCE ENGINEERING
(MECH 3261)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Maintenance which is done to keep the facilities in efficient condition is called
 (a) running maintenance (b) breakdown maintenance
 (c) preventive maintenance (d) corrective maintenance.
- (ii) OEE measures which of the following of an equipment?
 (a) Productivity (b) Availability
 (c) Quality (d) All of these.
- (iii) Scratch hardness test is done to check the quality of
 (a) a painted surface (b) a lubricant
 (c) rivetted joint (d) clad surface.
- (iv) Activities like modifications, modernizations, can be done during
 (a) proactive maintenance (b) running maintenance
 (c) preventive maintenance (d) scheduled maintenance.
- (v) When failure rate vs. time graph is plotted over the life span of a machine, it is called
 (a) fishbone diagram (b) bathtub curve
 (c) histogram (d) scattered diagram.
- (vi) Best method of lubrication of high speed anti friction bearing is
 (a) grease packing (b) forced oil
 (c) oil mist (d) cold air.
- (vii) Periodic checking of engine oil viscosity is a part of
 (a) running maintenance (b) preventive maintenance
 (c) breakdown maintenance (d) corrective maintenance.

- (viii) Objective of TPM implementation is to achieve
 (a) zero accident (b) zero breakdown
 (c) zero defect (d) all of these.
- (ix) MTBF stands for
 (a) Machining Time Between Failures
 (b) Machining Time Before Failures
 (c) Mean Time Between Failures
 (d) none of these.
- (x) During installation a machine is put on packing plates placed on foundation surface to allow
 (a) pouring of concrete (b) locating foundation bolt
 (c) machine levelling (d) foundation bolt tightening.

Group - B

2. (a) (i) Define TPM.
 (ii) What are the objectives of TPM?
 (b) Define the following TPM pillars, how they are implemented and their benefits in a tabular form
 (i) Autonomous maintenance
 (ii) Planned maintenance and
 (iii) Office TPM.
- (2 + 1) + (3 × 3) = 12**
3. (a) Define Overall Equipment Effectiveness.
 (b) An equipment is scheduled to run for an 8 hr. shift with 40 minutes scheduled break and on a particular shift it was not in operation for 40 mins due to unscheduled maintenance. The standard rate of production is 40 unit/hr. But that particular shift produced 240 units. 20 units were found defective out of 240 units produced. Calculate OEE.

4 + 8 = 12

Group - C

4. (a) (i) What are the advantages and disadvantages of centralised maintenance and decentralised maintenance?
 (ii) How do you decide whether a maintenance job should be outsourced or done in-house?

- (b) (i) What are the components of maintenance cost?
(ii) How maintenance costs are estimated?

$$(3 + 3) + (3 + 3) = 12$$

5. (a) (i) What is maintenance budget?
(ii) What is the purpose of making a maintenance budget?
- (b) (i) How does maintenance audit help an organization?
(ii) Describe the process of maintenance audit in an organization.

$$(2 + 4) + (2 + 4) = 12$$

Group - D

6. (a) Briefly describe the process of sub-surface crack detection using magnetic particle inspection method.
- (b) Mention where the following tools may be used.
(i) Feeler gauge (ii) Torque wrench (iii) Pipe wrench (iv) Chain pulley block (v) Spirit level (vi) Dial Gauge.

$$6 + 6 = 12$$

7. (a) Name different types of manual and automatic lubrication system that are used in industries.
- (b) (i) What are the functions of seals and packings?
(ii) Describe the radial shaft seals and O rings used to prevent leakage of oil.

$$6 + (2 + 4) = 12$$

Group - E

8. (a) What are the major steps of installation of a machine?
(b) Discuss the different methods of mounting of rolling element bearings.

$$4 + 8 = 12$$

9. (a) (i) What is hot clamping method of repairing a crack?
(ii) What are the causes of unusual wear of gear teeth?
- (b) What may be the causes of centrifugal pump delivery stoppage?

$$(4 + 4) + 4 = 12$$