

**MAINTENANCE ENGINEERING
(MECH 4141)**

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) When failure rate vs. time graph is plotted over the life span of a machine, it is called [(CO1) (Understand/LOCQ)]
(a) fishbone diagram (b) bathtub curve
(c) histogram (d) scattered diagram.
- (ii) Objective of TPM implementation is to achieve [(CO2) (Remember/LOCQ)]
(a) zero accident (b) zero breakdown
(c) zero defect (d) all of these.
- (iii) An overhead tank by a railway station reads “Last cleaning April, 2017. Next cleaning, October, 2017”. This is an example of [(CO6) (Understand/LOCQ)]
(a) breakdown maintenance (b) predictive maintenance
(c) planned maintenance (d) corrective maintenance.
- (iv) Zero breakdown is one of the objectives of [(CO2) (Understand/LOCQ)]
(a) Pareto analysis (b) six sigma (c) TPM (d) PDCA.
- (v) During installation a machine is put on packing plates placed on foundation surface to allow [(CO5) (Evaluate/HOCQ)]
(a) pouring of concrete (b) foundation bolt location
(c) machine levelling (d) foundation bolt tightening.
- (vi) Delivery of a centrifugal pump stopped may be due to [(CO1) (Analyse/IOCQ)]
(a) pump not primed (b) too low rpm
(c) suction head is too high (d) all of these.
- (vii) A systematic and independent examination whether the planned arrangements of maintenance activities have been performed is called [(CO4) (Understand/LOCQ)]
(a) maintenance audit (b) maintenance budget
(c) spare parts management (d) cost control.

- (viii) The important property of lubricant relevant to cold countries is
[(CO5) (Remember/LOCQ)]
(a) lubricity (b) viscosity
(c) calorific value (d) cloud point and pour point.
- (ix) Accelerated aging test done on painted panel to ascertain
[(CO 5) (Understand/LOCQ)]
(a) adhesion strength (b) impact strength
(c) probable life of painted surface (d) all of these.
- (x) Following costs are parts of maintenance cost except
[(CO4) (Understand/LOCQ)]
(a) material Cost (b) warranty cost
(c) direct labour cost (d) operation shut down cost.

Group - B

2. (a) (i) Define maintenance.
(ii) What are the different types of maintenance practices that are used in industries? [(CO1) (Understand/LOCQ)]
- (b) Write briefly about the following maintenance methods
(i) Planned Maintenance
(ii) Condition based maintenance. [(CO1) (Understand/LOCQ)]
- (1 + 3) + (4 + 4) = 12**
3. (a) Define the following terms (i) MTTF (ii) MTTR (iii) Availability [(CO2) (Analyse/ IOCQ)]
- (b) In a life test on a sample of 20 electric bulbs, they failed at the following test hours. Determine the MTTF of these bulbs. [(CO2) (Evaluate/HOCQ)]

840	1060	1200	1296	1362
861	1100	1225	1314	1389
901	1137	1251	1331	1401
993	1184	1270	1348	939

6 + 6 = 12

Group - C

4. (a) What is maintenance planning? What are the functions of a maintenance planner? What is maintenance scheduling? [(CO2) (Analyze/IOCQ)]
- (b) What are the components of maintenance cost? How maintenance costs are estimated? [(CO4) (Analyse/IOCQ)]
- 6 + 6 = 12**
5. (a) Discuss the following tools necessary for effective maintenance control system
(i) work control (ii) cost control (iii) quality control. [(CO4)(Evaluate/HOCQ)]
- (b) What are the different types of maintenance budgets that are in use in different industries? Discuss briefly about them. [(CO4)(Evaluate/HOCQ)]

6 + 6 = 12

Group - D

6. (a) Explain the seven tank pre-treatment process for M S sheet metal before painting. [(CO6)(Analyse/IOCQ)]
(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. [(CO5)(Analyse/IOCQ)]
6 + 6 = 12
7. (a) Write the function of an ideal lubricant. What are the desirable properties of an ideal lubricant? [(CO5) (Understand/LOCQ)]
(b) Write short notes on the following type of lubrication system
(i) chain oiler (ii) splash lubrication (iii) oil mist system.
[(CO5)(Remember/LOCQ)]
6 + 6 = 12

Group - E

8. (a) Describe how cracks found in a cast body of a machine may be repaired by (i) riveting and (ii) hot clamping method. [(CO6)(Analyse/IOCQ)]
(b) List out the factors which enhances the life of a rolling element bearing.
[(CO6)(Remember/LOCQ)]
6 + 6 = 12
9. (a) What are the advantages and disadvantages of power transmission by belt drive and gear drive. [(CO6)(Analyse/IOCQ)]
(b) Name different method of pipe joining processes to transport liquid to far off places. [(CO5)(Evaluate/HOCQ)]
6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	47.17%	34.91%	17.92%

Course Outcome (CO):

After the completion of the course students will be able to

- CO1 Identify the difference between repair and maintenance, their types and applications
- CO2 Implement TPM in an organization and evaluate overall equipment effectiveness
- CO3 Design a Maintenance organization and workout maintenance and resource planning
- CO4 Evaluate maintenance cost and prepare maintenance budget
- CO5 Select suitable maintenance tools and tackles and preferred lubrication system
- CO6 Apply appropriate maintenance procedures with suitable tools and equipment.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question;
HOCQ: Higher Order Cognitive Question

Department & Section	Submission link:
ME	https://classroom.google.com/c/NDAxOTMyMDA5NTc0