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C16-M-405

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BOARD DIPLOMA EXAMINATION, (C-16)

JUNE/JULY—2022

DME - FOURTH SEMESTER EXAMINATION

DESIGN OF MACHINE ELEMENTS

Time : 3 hours]

[Total Marks : 80

PART—A

- Instructions :** (1) Answer **all** questions.
(2) Each question carries **three** marks.
(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. List any six mechanical properties of materials. 3
2. Determine the safe tensile load for a M-36 bolt, if the safe tensile stress is 90N/mm^2 . 3
3. A hollow steel shaft has 200 mm external diameter and 125 mm internal diameter. Shear stress at outer surface is 64 N/mm^2 . Calculate the stress at inner surface. 3
4. Mention any three important factors for suitable power drive. 3
5. A shaft running at 120 r.p.m. carries a pulley of 400 mm diameter which drives a dynamo of 1000 r.p.m. by means of belt 10 mm thickness. Allowing for the thickness of belt and total slip of 5%, determine the diameter of the pulley on dynamo. 3
6. A wheel has 48 teeth and a circular pitch of 24 mm. Find (a) pitch circle diameter and (b) diametral pitch. $1\frac{1}{2}+1\frac{1}{2}$
7. State any three advantages of rolling contact bearing over sliding contact bearings. 3

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8. How are cams classified? 3
9. Write any three differences between governor and flywheel. $1\frac{1}{2}+1\frac{1}{2}$
10. State the function of flywheel. 3

PART—B

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. A steam engine cylinder of 350 mm effective diameter is subjected to a steam pressure of 1.8 N/mm^2 . The cylinder cover is connected by means of a 6 bolts. The bolts are tightened with initial load of 1.5 times that of steam load. The copper gasket of stiffness factor 0.5 is used to make the joint leak-proof. Find the size of the bolt so that the stress induced in the bolt does not exceed 100 N/mm^2 . 10

12. Design a CI flange coupling to connect two shafts in order to transmit 7.5 kW at 720 r.p.m. The following permissible stresses may be assumed. Permissible shear stress for the shaft, bolt and key material = 33 N/mm^2 . Permissible crushing stress for the bolt and key material = 60 N/mm^2 . Permissible shear stress for CI = 15 N/mm^2 . 10

13. A solid shaft made of steel is subjected to a B.M of 3000 Nm and a torque of 10000 Nm. The shaft material has an ultimate tensile stress of 700 N/mm^2 , and ultimate shear stress of 500 N/mm^2 . Considering factor of safety of 6, determine the diameter of the shaft. 10

14. A belt is required to transmit 15 kW from a pulley of 1000 mm diameter at 420 r.p.m. The angle of a lap is 160° and coefficient of friction is 0.3. If the safe working stress of belt material is 1.2 N/mm^2 , find the width of the belt. Thickness of the belt is 10 mm. 10

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15. Explain the following gear trains with neat sketches and state their applications : 10

(a) Simple gear train

(b) Compound gear train

16. A journal bearing whose diameter is 60 mm is subjected to a load of 4.5 kN while rotating at 180 r.p.m. If coefficient of friction is 0.02 and I/D ratio is 3, find 4+3+3

(a) Bearing pressure

(b) Power lost in friction

(c) Heat generated

17. Draw the displacement diagram and cam profile to give the following motion to a 20 mm roller follower :

(a) Outward stroke during 90° of cam rotation.

(b) Dwell for the next 30° of cam rotation.

(c) Return stroke during 120° of cam rotation.

(d) Dwell for the remaining part of cam rotation.

The stroke of the follower is 30 mm and the minimum radius of cam is 40 mm. The axis of the follower is passing through the axis of the cam. The follower moves with uniform acceleration and retardation during both strokes. 10

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18. The fly wheel in a punching machine has a mass of 700 kg and a radius of gyration 0.75 m. The punching operation absorbs 30 kJ of energy and friction accounts for 15% of the energy supplied. The capacity of the motor at 240 r.p.m. is 12 kW. If the punching operation takes 1.5 seconds, determine the speed fluctuation of fly wheel. 10

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