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C16-M-405

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BOARD DIPLOMA EXAMINATION, (C-16)

AUGUST/SEPTEMBER—2021

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. Define the terms (a) working stress and (b) factor of safety. 1½+1½
2. How is a screw thread designated? Give example. 3
3. Mention the types of couplings and give one example in each case. 3
4. Two pulleys 800 mm and 400 mm diameters which are fixed to two parallel shafts 4 m apart are connected by crossed belt. Find the length of belt required and angle of contact. 3
- * 5. Write the advantages of chain drive compared with belt drive. 3
6. A wheel has 48 teeth and circular pitch 20 mm. Find (a) pitch circle diameter and (b) module. 3
7. Write any three disadvantages of sliding contact bearings. 3
8. Define the following terms :
(a) Base circle
(b) Cam profile

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9. Define the * terms (a) co-efficient of fluctuation of speed and (b) co-efficient of fluctuation of energy. 3
10. State any three differences between flywheel and Governor. 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. Design and draw an eye bolt is to be used for lifting an electric machine load of 5 kN. Ultimate stress of the material is 600 MPa and the factor of safety is 6. Give the proportions of the eyebolt designed. 10
12. A solid steel shaft 100 mm diameter transmits power at 150 rpm. If shear stress developed is 24 N/mm² and modulus of rigidity is 0.8×10^4 N/mm², calculate—(a) torque on shaft, (b) power transmitted, (c) angular twist over a length of 600 mm and (d) shear stress at a radius of 30 mm. 10
13. Design a cast iron flange coupling to connect two shafts in order to transmit 7.5 kW power at 720 rpm. The following permissible stresses may be assumed. Permissible shear stress for shaft, bolts and key material = 33 N/mm². Permissible crushing stress for bolt and key material = 60 N/mm². Permissible shear stress for cast iron is 15 N/mm². 10
- * 14. Two pulleys 1.2 m and 0.5 m diameter are on parallel shaft 3.6 m apart, and are connected by an open belt drive. The belt has a mass of 0.9 kg/m length, and the maximum tension in it is not to exceed 2000 N. The larger pulley which is the driver runs at 3.5 rev/s and coefficient of friction between belt and pulley is 0.25. Calculate the power transmitted by the belt. 10
15. A set of spur gears has to transmit 32 kW, when the pinion rotates at 400 rpm. The gear ratio is 1:4. The permissible stresses for pinion and gear materials are 120 N/mm² and 100 N/mm² respectively. The pinion has 20 teeth and its face width is 14 times the module. Compute (a) module and (b) face width. 10

16. (a) A journal*bearing whose diameter is 60 mm is subjected to a load of 4.5 kN while rotating at 180 rpm. If coefficient of friction is 0.02 and L/D ratio is 3. Find (i) bearing pressure, (ii) power lost in friction and (iii) heat generated.
- (b) Write a short note on rolling contact bearings. 5+5
17. A cam is to be designed for a knife edge follower with the following data : 10
- (a) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
- (b) Dwell for the next 30°.
- (c) During the next 120° of cam rotation, the follower returns to its original position with simple harmonic motion.
- (d) Dwell during the remaining.
- Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft and the radius of the base circle of the cam is 40 mm.
18. (a) A solid disc of flywheel 0.4 m diameter and 100 mm thick is made from cast iron of density $7 \times 10^3 \text{ kg/m}^3$. Determine (i) moment of inertia of flywheel and (ii) kinetic energy at 1000 rev/min. 5
- (b) Explain the Watt governor with a neat sketch. 5

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