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C09–M–605

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BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2014

DME—SIXTH SEMESTER EXAMINATION

DESIGN OF MACHINE ELEMENTS

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

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 'hardness' and 'resilience'.

2. What size of hole must be drilled in an M24-bolt to make it uniform strength?

3. Mention the details of the screw thread M18×1·5-9h.

4. Write down the function of shafts and materials used in the manufacturing of shafts.

5. Give the classification of couplings.

6. A gear of 44 teeth has pitch circle diameter of 352 mm. What is its module and circular pitch?

7. Two pulleys 500 mm and 250 mm are connected by flat belt. Central distance between them is 1·5 m. Find the angle of contact for—

(a) open-belt drive;

(b) crossed-belt drive.

8. Write about the following terms related to a cam :

(a) Base circle

(b) Lift

(c) Dwell

9. Write the functions of a governor.

10. Define the following terms :

(a) Fluctuation of energy

(b) Fluctuation of speed

PART—B

10×5=50

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

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

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

11. A steam engine cylinder of 250 mm effective diameter is subjected to a steam pressure of 1·2 N/mm^2. The cylinder cover is connected by means of 6 bolts. The bolts are tightened with initial load of 1·5 times that of steam load. A copper gasket of stiffness factor 0·5 is used to make the joint leak proof. Find the size of the bolts so the stress induced in bolt is not to exceed 100 N/mm^2.

12. An MS shaft is to transmit 75 kW of power at 210 r.p.m. The allowable stress in the shaft is limited to 42 N/mm^2 and the angle of twist is not to exceed 1° in a length of 20 times the diameter. Calculate the suitable diameter for the shaft. Assume G 79 GN/m^2.

13. Design a cast iron flange coupling for a shaft transmitting 20 kW at 250 r.p.m. and having an allowable shear stress of 40 N/mm^2. The working stress in the bolts should not exceed 32 N/mm^2. Assume that the same material is used for shaft and key and the crushing stress is 105 N/mm^2. The maximum torque is 25% greater than the full-load torque. The shear stress for cast iron is 15 N/mm^2.

14. Design a cast iron spur gear of 500 mm PCD for shaft *A* to transmit 8 kW at 140 r.p.m. Assume that the design stress for m.s. shaft as 45 N/mm^2 and module as 10 mm. Design should include—

(a) number of arms;

(b) thickness of rim;

(c) gear shaft diameter;

(d) hub diameter and length.

15. A belt is required to transmit 15 kW from a pulley of 1000 mm diameter at 420 r.p.m. The angle of 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 belt if thickness of belt is 10 mm.

16. A three-speed reduction gearbox is to have the following spindle speed ratio as nearly as possible :

First gear—5 2 : 1

Second gear—3 : 1

Third gear—1 6 : 1

Output shaft and input shaft are to be inline and the centre distance which is horizontal between them and the lay shaft is 144 mm. All the gears are 4 mm module and the number of teeth on pinion is 20. Determine suitable number on teeth of gear wheels. Sketch the arrangement.

17. Draw the profile of a cam operating a knife edge follower from the following data :

(a) Lifts the follower through 25 mm during 60 degrees with SHM

(b) The follower remains rest for the next 45 degrees of rotation of the cam

(c) The follower then descends to its original position during 90 degrees rotation of the cam with SHM

The follower remains at rest for the remaining part of the revolution. The least diameter of the cam is 50 mm, the axis of knife edge follower passes through the axis of the camshaft.

18. *(a)* What are the steps involved in design procedure?

(b) Draw and mention the proportionate dimensions of hexagonal nut and square nut.

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