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BOARD DIPLOMA EXAMINATION, (C–09)
MARCH/APRIL—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 durability and reliability.

2. Write the possible ways of failure of bolts.

3. Define *(a)* pitch and *(b)* angle of thread of a screw thread.

4. List out types of couplings.

5. A solid shaft is required to transmit a torque of 20 kN-m. Find the necessary diameter of the shaft, if the allowable shear stress is $70 \, \text{N/mm}^2$.

6. State any three advantages of gear drive over belt drive.

7. Write down three important factors in the selection of type of drive of power transmission.

8. List the varieties of cams used.

9. Define effort and power 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 $1 \cdot 2$ 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 leakproof. Find the size of the bolts so that the stress induced in the bolts is not to exceed 100 N/mm^2.

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

13. Design a cast iron muff coupling to connect two shafts transmitting 40 kW at 200 r.p.m. with a capability of maximum torque 25% greater than the mean torque. The shaft and the key are made of mild steel for which permissible shear and crushing stresses are 30 MN/m^2 respectively. Permissible shear stress in cast iron is 15 MN/m^2.

14. 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 in-line 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 of teeth on gearwheels. Sketch the arrangement.

15. Design a reverted gear train of four gears to give a speed reduction of 8. All gears are to be of the same pitch. No gear is to have less than 14 teeth. Draw a simple sketch of the arrangement of gears.

16. A flat belt drive is used to transmit 15 kW power from an electric motor to a flour mill. The following data are available :

Thickness of belt	=	10 mm
Density of belt material	=	1·1 gm/cm^3
Motor pulley diameter	=	1400 mm
Motor pulley speed	=	135 r.p.m.
Stress in the belt material	=	2·4 MN/m^2
Angle of contact	=	2·75 radians
Coefficient of friction	=	0·3

Determine the width of the belt.

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

Outward stroke through 40 mm during 120° of cam rotation; dwell for 60° of cam rotation; return stroke during the next 90°. Dwell for the remaining part of cam rotation. The minimum radius of cam is 35 mm. The line of stroke of the follower is coinciding with the centre of the cam axis and the follower moves with simple harmonic motion.

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

(b) An eyebolt is to be used for lifting a load of 100 kN. Design the bolt, if the tensile stress is not to exceed 100 N/mm^2. Draw a proportionate sketch of it.

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