



C09-M-605

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BOARD DIPLOMA EXAMINATION, (C-09)  
MARCH/APRIL—2018  
DME—SIXTH SEMESTER EXAMINATION

DESIGN OF MACHINE ELEMENTS

Time : 3 hours ]

[ Total Marks : 80

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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. List out six factors which govern the design of machine element.
2. How is a screw thread designated? Give an example.
3. What are the possible ways of failure of the bolts?
4. What is a key? State its functions.
5. Classify couplings and give an example for each type.
6. Define velocity ratio and slip of belt.
7. A wheel has 48 teeth and circular pitch 20 mm. Find (a) pitch circle diameter and (b) module.

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8. What information is required to draw a cam profile?
9. Define sensitiveness and stability of governor.
10. State any three differences between flywheel and governor.

**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) Explain the step-by-step procedure for designing a machine element.

(b) Describe the bolts of uniform strength.

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

Assume  $G = 79 \text{ GN/m}^2$ .

13. Design a cast iron muff coupling using the following data :

(a) Mild steel shaft transmit 80 kW at 150 r.p.m.

(b) Allowable shear and crushing stresses for the shafts and key material are  $40 \text{ N/mm}^2$  and  $100 \text{ N/mm}^2$  respectively

(c) The permissible shear stress in the muff is  $15 \text{ N/mm}^2$

Assume the maximum torque transmitted is 25% greater than the mean torque.

14. 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  $160^\circ$  and coefficient of friction is 0.3. If the safe working stress of belt material is  $1.2 \text{ N/mm}^2$ , find the width of belt. Thickness of belt is 10 mm.

15. Explain (a) <sup>\*</sup> simple gear train and (b) compound gear train with neat sketches.
16. A belt 125 mm wide and 6 mm thick is used to transmit power at optimum belt speed. If the limiting stress in the belt material is  $1.8 \text{ MN/m}^2$ , calculate the absolute maximum power that can be transmitted by the belt. Assume  $v = 160$ ,  $\mu = 0.3$  and mass of belt per meter length as  $1.2 \text{ kg}$ .
17. Draw the cam profile to give the following motion to a 20 mm roller follower :
- (a) Outward stroke during  $90^\circ$  of cam rotation
  - (b) Dwell for the next  $30^\circ$  of cam rotation
  - (c) Return stroke during  $120^\circ$  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 the 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.
18. An eyebolt has to lift a load of 60 kN. Ultimate strength of steel is  $600 \text{ N/mm}^2$  and factor of safety is 6. Design eyebolt and draw a proportionate sketch.

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