



C16-M-405

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BOARD DIPLOMA EXAMINATION, (C-16)
OCT/NOV—2018
DME—FOURTH 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. List out any six mechanical properties of metals. $\frac{1}{2} \times 6 = 3$
2. What size of hole must be drilled in M34 bolt to make it uniform strength.
3. State the differences between a shaft and an axle.
4. Write any two advantages of V-belts over flat belts.
- * 5. State the advantages of silent chain over roller chain.
6. State any three advantages of gear drive over belt drive.
7. How are bearings classified?
8. Define the terms (a) base circle, (b) dwell and (c) lift related to cam.
9. What is turning moment diagram? Draw simple turning moment diagram for 4-stroke engine. $1\frac{1}{2} + 1\frac{1}{2} = 3$
10. Define the effort and power of governor.

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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 leakproof. Find the size of bolts so that the stress induced in the bolts is not to exceed 100 N/mm^2 .

12. A mild steel shaft transmits 40 kW power at 280 r.p.m. Maximum torque transmitted exceeds mean torque by 25%. Maximum shear stress is 60 N/mm^2 and the angle of twist should not exceed 1° in a length of 20 diameter. Modulus of rigidity is 80 GN/m^2 . Compute the diameter of the shaft.

13. Design and draw a muff coupling to connect two shafts transmitting 100 kW power at 200 r.p.m. The permissible shearing and crushing stresses for shaft and key material are 50 N/mm^2 and 100 N/mm^2 respectively. The material for muff is cast iron with a permissible shear stress of 15 N/mm^2 . Assume that the maximum torque transmitted is equal to the mean torque.

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

Thickness of belt : 10 mm

Density of belt material : 1.1 gm/cm^2

Motor pulley diameter : 1400 mm

Motor pulley speed : 135 r.p.m.

Stress in the belt : 2.4 MN/m^2

Angle of contact : 2.75 radians

Coefficient of friction : 0.3

Determine the width of the belt.

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

Bottom (first) gear 5.2 : 1; second gear 3 : 1; third gear 1.6 : 1; output shaft and input shafts 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 to be of 4 mm module and the number of teeth on pinion is 20.

Determine the suitable number of teeth on all the gear wheels. Sketch the arrangement.

16. A foot step bearing supports a shaft of 120 mm diameter which is counterbored at the end with a hole diameter of 30 mm. The shaft rotates at 140 r.p.m. and subjected to a bearing pressure of 0.8 MPa. Find (a) the load to be supported, (b) the power lost in friction and (c) the heat generated. Take, coefficient of friction as 0.015.

17. A cam is to give the following motion to a knife-edged follower :

- (a) Out stroke during 90° of cam rotation
- (b) Dwell for the next 30° of cam rotation
- (c) Return stroke during next 120° of cam rotation
- (d) Dwell for the remaining 120° of cam rotation

The stroke of the follower is 40 mm and the minimum radius of the cam is 30 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

18. (a) A rolling mill requires an average of 300 kW during 10 seconds that the billet is passing through the mill. An electric motor whose constant output is 250 kW drives the mill, and during the operation the flywheel falls from 80 rev/min to 70 rev/min. Find moment of inertia of the flywheel.
- (b) Explain the porter governor with a neat sketch. 5+5=10

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