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BOARD DIPLOMA EXAMINATION, (C–16)
OCTOBER—2020
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. Define—

     (a) working stress;

     (b) factor of safety.

2. Mention the details of screw threads M18 × 1·5 – 9h.

3. What is a key? State its function.

4. What are the advantages of chain drive compared with belt drive?

5. Mention any three important factors required to select a suitable power drive.

6. A wheel has 48 teeth and circular pitch of 20 mm. Find *(a)* pitch circle diameter and *(b)* module.

7. Write any three differences between sliding and rolling bearings.

8. Define—

(a) base circle;

(b) dwell;

(c) stroke.

9. In what way does a flywheel differ from a governor?

10. Define the terms related to governor (a) sensitiveness and (b) stability.

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PART—B   10×5=50

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

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

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

11. The cylinder head of a steam engine is subjected to a steam pressure of $0.7 \, N/mm^2$. It is held in position by means of 10 bolts. A soft copper gasket is used whose $K = 0.5$ to make the joint leakproof. The effective diameter of the cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed to $100 \, N/mm^2$.

12. A shaft is subjected simultaneously to a torque of 28500 Nm and bending moment of 21000 Nm. Find the diameter of the shaft if the maximum normal stress is $55 \, N/mm^2$ and maximum shear stress is $30 \, N/mm^2$.

13. Design a muff coupling to connect two shafts transmitting 100 kW at 250 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 of muff is CI with a permissible shear stress of $15 \, N/mm^2$. Assume that the maximum torque transmitted is equal to the mean torque.

14. A leather belt 150 mm wide and 8 mm thick transmits power to a pulley of 600 mm diameter running at 150 r.p.m. to a pulley running at 375 r.p.m. by an open belt drive. The distance between shafts is 2·4 m. the coefficient of friction is 0·25. The density of belt material is $1.1 \, gm/cm^3$ and the permissible stress is $2.5 \, MN/m^2$. Compute the maximum power that can be transmitted.

15. Describe with a neat sketch the working of a motor car (sliding type) gear box.

16. A journal bearing rotating at 140 r.p.m. is subjected to a load of 28 kN. The diameter of the journal is 125 mm and (l/d) ratio is 2·8. Find *(a)* bearing pressure *(b)* frictional torque *(c)* power lost in friction *(d)* heat generated *(e)* heat dissipated. Take coefficient of friction, $\mu = 0·018$.

17. Draw the cam profile to give the follower motion to a roller follower. Outward stroke through 60 mm during 120° of cam rotation : Dwell 90° of cam rotation. Return stroke during 120° of cam rotation : Dwell for the remaining part of cam rotation. The cam is rotating in clockwise direction with minimum radius of 30 mm. The line of stroke of the follower passes through the centre of the cam axis and the follower moves with uniform velocity during out storke and return stroke. The diameter of the roller is 20 mm.

18. A flywheel rotating at 600 r.p.m. does 1950 joules of work per revolution. The coefficient of fluctuation of energy is 0·2 and that of the speed is 0·02. Mass of the flywheel is 80 kg. Compute, *(a)* power transmitted by the shaft on which flywheel is mounted *(b)* maximum fluctuation of energy *(c)* diameter of the flywheel and *(d)* mass moment of inertia.

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