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BOARD DIPLOMA EXAMINATION, (C–09)
APRIL/MAY—2015
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) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

(4) Assume suitable data whenever necessary.

1. List any six important mechanical properties of metal.

2. Find the safe load for the bolt of M5 assuming a safe tensile stress of 40 N/mm^2.

3. Draw the hexogonal bolt with proportionate dimensions.

4. A hollow steel shaft 230 mm external diameter and 150 mm internal diameter transmits 1600 kW at 150 r.p.m. Calculate the shear stress induced in the shaft material.

5. Design a rectangular sunk key for a shaft of 80 mm diameter. The parmissible shearing and crushing stresses in the key are 30 N/mm^2 and 70 N/mm^2 respectively.

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6. Two parallel shafts 6 m apart are provided with pulleys 800 mm and 600 mm in diameter. Find the length of belt for turning the two shafts in same direction.

7. Define module and diametral pitch.

8. Classify the followers in cam mechanism.

9. Write the function of a flywheel and the turning moment diagram.

10. Write the classification of centrifugal governor.

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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 criterion for valuation is the content but not the length of the answer.

11. *(a)* List out any six factors to be considered while designing a product or an element.

      (b) *(i)* Draw any two thread profiles and show all the features of these thread profiles.

           (ii) What do you understand by bolts of uniform strength?

12. Design and draw an eyebolt to be used for lifting a load of 50 kN. The permissible tensile stress of the material is 100 N/mm^2. Give the proportions of the eyebolt designed.

13. A solid circular shaft is subjected to a bending moment of 2000 N-m and a torque of 9000 N-m. The shaft is made of steel having ultimate tensile stress of 600 MPa and ultimate shear stress of 400 Mpa. Assume factor of safety as 5. Determine the diameter of the shaft.

14. Design a CI flange coupling (only flanges and bolts) to connect two shafts in order to transmit 5 kW at 700 r.p.m. The permissible shear stress for the shaft bolts and the key material is 30 N / mm^2. the permissible crushing stress for the bolt and the key material is 50 N/mm^2, and the permissible shear stress for CI is 18 N/mm^2.

15. Two pulleys, 400 mm and 150 mm diameter, are mounted on parallel shafts 2 m apart and are connected by a cross belt. What power can be transmitted by the belt when the larger pulley rotates at 150 r.p.m., if the maximum permissible tension in the belt is 900 N and the coefficient of friction between the belt and the pulley is 0·35?

16. A three-speed reduction gearbox is having 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 shaft are to be in line and the centre distance 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 20. Determine the suitable number of teeth on all the gear wheels. Sketch the arrangement.

17. A motor shaft rotating at 1200 r.p.m. has to transmit 15 kW through a spur gear mounted on the motor shaft. The number of teeth on the gear wheel is 70 of module 4 mm. The gear wheel is made of cast iron with a maximum safe stress of 56 N/mm^2. Design a spur gear assuming the tooth factor, service factor and velocity factor 0·2, 0·95 and 0·4 respectively.

18. A cam is to be designed for a knife-edge follower with the following data :

(a) Cam lift is 30 mm during 90° of cam rotation with simple harmonic motion

(b) Dwell for the next 30°

(c) During the next 90° of cam rotation, the follower returns to its original position with simple harmonic motion

(d) Dwell during the remaining 150°

Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The minimum radius of the base circle of the cam is 40 mm.

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