



C09-M-605

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BOARD DIPLOMA EXAMINATION, (C-09)

MARCH/APRIL—2016

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.

1. What are the factors to be considered while selecting the material for a given product?
2. What is meant by bolt of uniform strength?
3. Write the specification of bolt.
4. What is the difference between a spindle and axle? Give one example for each.
5. What shear stress is induced in a square key of 12 mm side and 75 mm long, placed in a 50 mm diameter shaft, if 15 kW power is transmitted at 200 r.p.m.?
6. Find the pitch diameter, and module of a toothed gear having 36 teeth and a circular pitch of 13 mm.
7. Define velocity ratio and slip in the belt.
8. Write about the following terms related to a cam :
 - (a) Base circle
 - (b) Lift
 - (c) Dwell
9. What is a governor? State its functions.

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10. Distinguish ^{*} between governor and flywheel.

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. The 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 the bolts so that the stress induced in the bolts is not to exceed 100 N/mm^2 .

12. Design a CI flange coupling to connect two shafts in order to transmit 10 kW power at 400 r.p.m. Permissible shear stress for shaft, bolt and key material 33 N/mm^2 . Permissible crushing stress for bolt and key material 60 N/mm^2 , permissible shear stress for CI 15 N/mm^2 .

13. A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 1000 N-m. The shaft is made of steel having ultimate tensile stress of 700 MPa and ultimate shear stress of 500 MPa. Assume factor of safety as 6, determine the diameter of the shaft.

^{*} 14. Explain the following gear trains with neat sketches and mention their applications :

(a) Compound gear train

(b) Simple gear train

15. Two pulleys 1.2 m and 0.5 m diameter are on parallel shaft 3.6 m apart, and are connected by a crossed belt drive. The belt has a mass of 0.9 kg/m length, and the maximum tension in it is not to exceed 2000 N. The larger pulley which is the driver runs at 3.5 rev/s and coefficient of friction between belt and pulley is 0.25. Calculate the power transmitted by the belt.

16. Design a ^{*}reverted gear train of four gears to a speed reduction of 12. All gears are to be of same pitch and no gear shall have less than 16 teeth. Sketch the arrangement by showing all the sizes.
17. Draw the profile of a cam operating a knife edge follower with the given data :
- (a) Out stroke is 30 mm and occurs during 120° of cam rotation
 - (b) Follower remains at rest for the next 60° of cam rotation
 - (c) Follower then descends to its original position during the next 150° of cam rotation
 - (d) Follower remains at rest for the remaining part of cam rotation

The minimum diameter of the cam is 60 mm. The cam rotates with uniform velocity during the out stroke and return stroke. The axis of the follower passes through the axis of the cam.

18. (a) Write the step-by-step procedure for designing a machine element.
- (b) Design and sketch a steel eyebolt using the following parameters :

Lifting load = 80 kN

Ultimate strength of steel = 540 N/mm²

Factor of safety = 6

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