

**3783**  
**BOARD DIPLOMA EXAMINATION, (C-09)**  
**MARCH/APRIL - 2019**  
**DIPLOMA IN MECHANICAL ENGINEERING**  
**DESIGN OF MACHINE ELEMENTS**  
**SIXTH SEMESTER EXAMINATION**

**Time: 3 Hours**

**Total Marks: 80**

**PART - A (10 x 3 = 30 Marks)**

*Note 1: Answer all questions and each question carries 3 marks*

*2: Answers should be brief and straight to the point and shall not exceed 5 simple sentences*

1. Define Durability and Reliability
2. Two machine parts are fastened together tightly by means of M28 tap bolt. Find the stress that is set up in this bolt by initial tightening.
3. Define screw thread. What is its purpose?
4. State the difference between a shaft and an axle.
5. Write down the classification of keys.
6. Define the following :
  - (a) Circular pitch
  - (b) Module
  - (c) Pressure angle
7. Mention any three important factors required to select a suitable power drive.
8. Define the terms related to Cam profiles.
9. List three differences between flywheel and governor.
10. Define the following terms related to governors.
  - a. Hunting
  - b. Isochronism

**PART - B (5 x 10 = 50 Marks)**

*Note 1: Answer any five questions and each question carries 10 marks*

*2: The answers should be comprehensive and the criteria 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<sup>2</sup>. 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 leak proof. Find the size of the bolts so the stress induced in bolt is not to exceed 100 N/mm<sup>2</sup>.
12. Design a protective cast iron flange coupling for a steel shaft transmitting 15 kW at 200 rpm and having an allowable shear stress of 40 N/mm<sup>2</sup>. The working stress in the bolts should not exceed 30 N/mm<sup>2</sup>. Assume that the same material is used for the shaft and key and the crushing stress is twice the value of its shear stress. The maximum torque transmitted is 25% greater than the mean torque. The shear stress for cast iron is 14 N/mm<sup>2</sup>.

13. A solid circular steel shaft is subjected to a bending moment of 2 KN-m and twisting moment of 1.5 KN-m having an ultimate tensile stress of  $700 \text{ N/mm}^2$  and ultimate shear stress of  $500 \text{ N/mm}^2$ . Assuming a factor of safety of 6, determine the diameter of the shaft.
14. Explain the following gear trains with neat sketches and mention their applications:
  - a. Epicyclic gear train
  - b. Simple gear train.
15. A set of spur gears has to transmit 40 kW, when the pinion rotates at 400 rpm. The gear ratio is 1:4. The permissible stress for pinion and driver gear materials are  $120 \text{ N/mm}^2$  and  $100 \text{ N/mm}^2$  respectively. Determine module and face width, if the pinion has 20 teeth and face width is 15 times the module.
16. Two parallel shafts, whose centre lines are 4.8 m apart, are connected by an open belt drive. The diameter of the larger pulley is 1.5 m and that of small pulley is 1.05 m. The initial tension is 3 kN. The mass of the belt is 1.5 kg/m length. The coefficient of friction between belt and pulley is 0.3. Taking centrifugal tension into the account, calculate the power transmitted, when the smaller pulley rotates at 400 rpm.
17. Draw the displacement diagram and cam profile to give the following motion to a Flat follower: Outward stroke through 40 mm during  $120^\circ$  of cam rotation; Dwell for  $60^\circ$  of cam rotation, Return stroke during the next  $90^\circ$ . Dwell for the remaining part of cam rotation. The minimum radius of cam is 35 mm. The line of stroke of the follower is coinciding with the centre of the cam axis and the follower moves with Simple harmonic motion.
- 18A. What are the factors which govern the design of machine part? Explain any of two.
- B. An eye bolt to be used for lifting a load of 90 kN. Design and draw the eye bolt, if the tensile stress is not exceeding  $90 \text{ N/mm}^2$ .

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