

**6450**  
**BOARD DIPLOMA EXAMINATION**  
**JUNE - 2019**  
**DIPLOMA IN MECHANICAL ENGINEERING**  
**DESIGN OF MACHINE ELEMENTS**  
**FOURTH SEMESTER EXAMINATION**

Time: 3 Hours

Total Marks: 80

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

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. State the general procedure in machine design
2. Find diameter of the hole to be drilled to make M40 bolt as bolt of uniform strength
3. Find the torque that can be transmitted by a hollow steel shaft having inner and outer diameters as 20 mm and 30 mm, if the maximum shear stress is limited to 40 N/mm<sup>2</sup>
4. What is creep in a belt drive and what is its effect
5. Write the condition for maximum power transmission in the belt drive by considering the centrifugal tension and write expression for maximum power .
6. Define the terms a) circular pitch and b) back lash
7. Define equivalent dynamic load of a rolling contact bearing
8. Define base circle and prime circle.
9. Draw the turning moment diagram of a four stroke I.C. engine
10. Write the functions of the governor

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

Note 1: Answer any five questions and each 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. Explain about various stresses induced in the bolts under different conditions with formulas and legible sketches.

12. A rigid flange coupling is used to connect a 45kW, 1440 rpm electric motor to a centrifugal pump. The starting torque of the motor is 15% of the rated torque. Design flange coupling by taking allowable shear, tensile and crushing stresses as 40 MPa, 90 MPa and 130 MPa respectively for shaft, key and bolts. the permissible shear stress of cast iron is 15MPa
13. A solid shaft is transmitting 25kW power at 240rpm . The ends of the shaft are supported on bearings which are at 1.5m apart. A gear is mounted on the shaft at the midpoint and the net force acting on it is 1200 N. Design the shaft if the allowable shear and bending stresses of the shaft material are 50 N/mm<sup>2</sup> and 90 N/mm<sup>2</sup> respectively. use Rankine and Guest theories of failure
14. A 100 mm wide and 10mm thick belt transmit 5kW power between two parallel shafts. distance between the shaft centres is 1.5 m and the diameter of the smaller pulley is 440 mm. The driving and driven shafts rotate at 60 rpm and 150 rpm respectively. Find the stress in the belt if two pulleys are connected by crossed belt  
Take the coefficient friction  $\mu = 0.25$
15. A three speed sliding gear box of a motor car is required to give speed ratio of 4:1, 3:1 and 2:1 for the first, second and third gear respectively. Module of all the gears is 5 mm and the center distance between the two shafts is 80 mm. Find suitable number of teeth for all gears, if the number of teeth on the smallest gear is 18
16. The shaft of a collar thrust bearing rotates at 200 rpm and carries an end thrust of 10 tonnes. The outer and the inner diameters of the bearing are 480 mm and 280 mm respectively. If the power lost in friction is not to exceed 8 kW, determine the coefficient of friction of the lubricant of the bearing
17. Draw the cam profile for the knife edge follower with uniform velocity outstroke 120°, dwell 30°, return stroke 90° and dwell for the remaining period of the cam rotation. stroke of the follower is 30mm and minimum radius of the cam is 25mm, axis of the follower passes through the axis of the cam shaft.
18. Explain the porter governor with a neat sketch