6450
BOARD DIPLOMA EXAMINATION
MARCH/APRIL - 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. What are the factors to be considered for the design of machine elements

2. Find the stress in a M24 bolt when it is subjected to a tensile load of 1.2 kN

3. A solid shaft of diameter 25 mm is transmitting a torque of 900 N-m. Find the angle of twist per unit length by taking G = 80 GPa

4. Write the condition for maximum power transmission in the belt drive by considering the centrifugal tension and write expression for max power

5. What are the factors required to select a suitable power drive

6. Define the terms a) Diametral pitch b) Module

7. State any four desirable properties of a good bearing material

8. A double acting engine develops 100kW power running at a mean sped of 150rpm. Determine work done per stroke

9. Write the differences between governor and flywheel

10. How do you classify the followers of cams ?

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. The cylinder head of a steam engine is connected to cylinder flange by means of 10 bolts. The effective cylinder diameter is 400 mm. The maximum pressure inside the cylinder is 10 bar. The material of bolts is plain carbon steel having yield strength in tension is 540 N/mm^2 and factor of safety is 6. Find the size of bolts by considering the effect of initial tightening and the stiffness factor as 0.6

12. Design a shaft to transmit 20 kW at 300 rpm. The shaft is subjected to a bending moment of 500N-m and the allowable tensile stress and shear stress of the shaft material are 90MPa and 50MPa respectively. Check the dimensions for torsional rigidity if the allowable angle of twist per unit length of the shaft is 1.5^0. Take G = 80 GPa

13. A centrifugal pump is driven by an electric motor of 45 kW at 1440 rpm using a flange coupling. Permissible shear stress for shaft, bolt and key materials is 90 MPa. Permissible crushing stress for bolt and key is 120 MPa. Permissible shear stress for C.I hub and flange is 14 MPa. Design and sketch the coupling

14. A belt drive is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and 80 mm wide. The diameters of the smaller and larger pulleys are 300 mm and 600 mm respectively. The smaller pulley which is driver is rotating at 250 rpm. The distance between the centres of the pulleys is 2.5 m. Find the stress in the belt Take coefficient and friction $\mu = 0.25$

15. It is required to design a pair of spur gears with 20° full-depth involute teeth based on the Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 kW, 1440 rpm motor. The starting torque of the motor is 125% of the rated torque. The speed reduction is 4 : 1. The pinion as well as the gear is made of plain carbon steel (σ_b = 200 N/mm²). The factor of safety can be taken as 1.5. Design the gears

16. A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine90 r.p.m., find the power absorbed in friction at the thrust block, assuming (a) Uniform pressure   (b) uniform wear

17. A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below :

    i. To raise the valve through 50 mm during 120° rotation of the cam ;

    ii. To keep the valve fully raised through next 30°;

    iii. To lower the valve during next 60°; and

    iv. To keep the valve closed during rest of the revolution i.e. 150° ;

    The diameter of the roller is 20 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion

18. Explain the function of watt governor and porter governor with a neat sketches.

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