Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 20860

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fifth/Sixth Semester

Mechanical Engineering

ME 8593 — DESIGN OF MACHINE ELEMENTS

(Common to : Automobile Engineering / Industrial Engineering / Mechanical Engineering (Sandwich) / Mechanical and Automation Engineering / Mechatronics Engineering)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define toughness.

2. Discuss the methods to reduce stress concentration in threaded parts.

3. What is meant design by rigidity?

4. What for the critical speed of the shaft is to be determined. Answer from design point of view.

5. How will you designate ISO metric thread?

6. Sketch parallel and transverse weld on a boiler shell.

7. Give the relation between active and inactive and total number of springs in compression spring.

8. Name the stresses induced in the rim of flywheel.

9. State the importance of Sommerfield number.

10. What do you mean by (a) Static (b) Dynamic capacity of bearing.

PART B — (5 × 13 = 65 marks)

11.   (a)   (i)   Explain the importance of material selection decision for machine elements.

(ii)   A trolley runs on four wheels mounted on two axles with a maximum load of 20 tonnes. The trolley is attached to each axle through two bearings. The distance of wheels on the axle is 800 mm and symmetrically located. Design a hollow axle taking half of its outer diameter and the bending stress is 60 MPa. Also obtain the length of the bearing if maximum permissible bearing pressure is 4MPa.   (5 + 8 = 13)

Or

(b)   (i)   Discuss the necessity of theories of failures.

(ii)   A bar of certain material, 40 mm diameter and 1.2 m long, has a collar securely fitted to one end. It is suspended vertically with the collar at the lower end and a mass of 2000 kg is gradually lowered on to the collar. Producing an extension in the bar of 0.25 mm. Find the height from which this load could be dropped on to the collar if the maximum tensile stress in the bar is to be 100 MN/m².   (5 + 8 = 13)

12.   (a)   (i)   Write down the design procedure of Bushed pin type flexible couplings.

(ii)   A rigid type of coupling is used to connect two shafts transmitting 15 kW at 200 rpm. The shaft keys and bolts are made of C 45 steel and the coupling is of cast iron. Design the coupling.   (6 + 7 = 13)

Or

(b)   A solid shaft is to transmit power from an electric motor to a machine through a pulley by means of a vertical belt drive with unit speed ratio. The pulley weight 250 N and is overhanging at a distance of 120 mm from the bearing. Diameter of pulley is 200 mm. Maximum power transmitted at 150 rpm is 3 kW. Co efficient of friction between the belt and pulley is 0.25. Combined shock and fatigue factor in torsion is 1.5 and in bending is 2.0, permissible shear stress for the shaft material is 40 N/mm², Design the shaft standard diameters from R 20 series in are 20, 22.4, 25, 28, 31. 5, 40, 45, 50, 56, 63, 71 and 80.   (13)

13.   (a)   (i)   Explain the design procedure of knuckle joint? What are its limitations?

(ii)   An electric motor weighing 5 kN is lifted by means of an eye bolt which has already been screwed into it. Design the eye bolt if the permissible stresses for the bolt material are 60 MPa, 30 MPa in tension, shear and crushing respectively.   (6 + 7 = 13)

Or

2   20860

B.E/B.TECH, M.E/M.TECH, MBA, MCA, POLYTECHNIC & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

(b) (i) Describe the types of failure in riveted joints?

(ii) A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 and 50 N/mm² respectively. Determine the required length of each parallel fillet weld. (5 + 8 = 13)
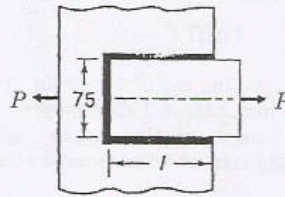
14. (a) (i) Illustrate the importance of providing rubber in main spring suspension. What are the applications of rubber spring?

(ii) A helical compression spring of the exhaust valve mechanism is initially compressed with a pre-load of 375 N. When the spring is further compressed and the valve is fully opened, the torsional shear stress in the spring wire should not exceed 750 N/mm². Due to space limitations, the outer diameter of the spring should not exceed 42 mm. The spring is to be designed for minimum weight. Calculate the wire diameter and the mean coil diameter of the spring. (5 + 8 = 13)

Or

(b) A punching Machine makes 20 working strokes per minute and is capable of punching 30 mm diameter holes in 18 mm thick steel plates having an ultimate shear stress of 300 N/mm², the punching operates takes place in 1/10th of a revolution of the crank shaft. Assuming a mechanical efficiency of 80% estimate he power needed for the motor driving the machine. Find the suitable dimensions of rim section of the flywheel, which is to revolve at 9 times the speed of the crankshaft by gear arrangement. The permissible coefficient of fluctuation of speed is 0.1. Assume suitable data if required. (13)

15. (a) (i) Demonstrate the procedure for the selection of Roller contact bearings.

(ii) A 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0.05 mm and the viscosity of the oil is 0.021 kg / m-s at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the maximum safe speed. (5 + 8 = 13)

Or

3   20860