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Question Paper Code : 21569

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fifth Semester

Mechanical Engineering

ME 2303/ME 53/10122 ME 504 – DESIGN OF MACHINE ELEMENTS/ MACHINE DESIGN

(Common to Fifth Semester, Automobile Engineering, Fourth Semester – Manufacturing Engineering, Industrial Engineering and Management and Industrial Engineering)

(Regulation 2008/2010)

(Common to PTME 2303 – Design of Machine Elements for B.E. (Part-Time) Fourth Semester Mechanical Engineering — Regulation 2009)

Time : Three hours Maximum : 100 marks

Note: Approved Design Data Book is permitted to use in the examination.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are unilateral and bilateral tolerances?

2. What are the various theories of failure?

3. What is the main use of woodruff keys?

4. Name any two of the rigid and flexible couplings.

5. Define the term self locking of power screws.

6. Write any two advantages and disadvantages of welded joints over riveted joints.

7. What is surge in springs?

8. Define Co-efficient of fluctuation of speed in flywheel.

9. What is meant by journal bearing?

10. What do you mean by life of an individual bearing?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain various phases in Design using a flow diagram and enumerate the factors influencing the machine design. (12)

(ii) What is meant by hole basis system and shaft basis system? Which one is preferred and why? (4)

Or

(b) (i) What is the difference between Gerber curve and soderberg and Goodman lines? (6)

(ii) A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm^2. The corrected endurance limit stress for the machine component is 270 N/mm^2. The ultimate tensile strength and yield strength of material are 600 and 450 N/mm^2 respectively. Find the factor of safety using :

(1) Gerber theory

(2) Soderberg line

(3) Goodman line and

(4) Also, find factor of safety against static failure. (10)

12. (a) A steel solid shaft transmitting 15 kW at 200 rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear. Determine the diameter of the shaft. (16)

Or

(b) 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 C45 steel and the coupling is of cast iron. Design the coupling. (16)

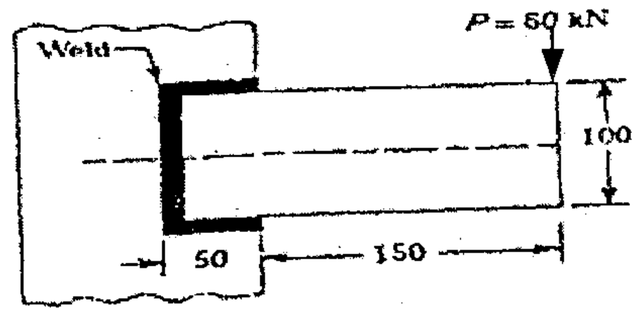
13. (a) Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically.

Tensile stress = Compressive Stress = 50 MPa, Shear stress = 35 MPa and Crushing Stress = 90 MPa. (16)

Or

(b) (i) What is an eccentric loaded welded joint? Describe procedure for designing such a joint. (8)

(ii) A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in figure. Determine the weld size if shear stress in the same is not to exceed 140 MPa. (8)



All dimensions in mm

14. (a) A safety valve of 60 mm diameter is to blow off at a pressure of 1.2 N/mm^2. It is held on its seat by a close coiled helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the materials of the wire is limited to 500 MPa. The modulus of rigidity for the spring material is 80 kN/mm^2 calculate :

(i) Diameter of the spring wire,

(ii) Mean coil diameter,

(iii) Number of active turns,

(iv) Pitch of the coil. (16)

Or

(b) A machine punching 38 mm holes in 32 mm thick plate requires 7 N-m of energy per sq. mm of sheared area, and punches one hole in every 10 seconds. Calculate the power of the motor required. The mean speed of the flywheel is 25 meters per second. The punch has a stroke of 100 mm. find the mass of the flywheel required, if the total fluctuation of speed is not to exceed 3% of the mean speed. Assume that the motor supplies energy to the machine at uniform rate. (16)

15. (a) Design a journal bearing for 12 MW, 1000 rpm steam turbine, which is supported by two bearings. Take the atmospheric temperature as 16°c and operating temperature of oil as 60°C. Assume viscosity of oil as 23 Ns/m^2. (16)

Or

(b) Select a suitable deep groove ball bearing for supporting a radial load of 10 KN and an axial load of 3 KN for a life of 4000 hours at 800 rpm. Select from series 63. Calculate the expected life of the selected bearing. (16)
