6 **Reg. No. _____**

Karunya University

(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

Model Question Paper

Subject Title: DESIGN OF MACHINE ELEMENTS **Time: 4 hours**
Subject Code: 09ME206 **Maximum Marks: 100**

(Use of approved design data book is permitted)
Answer ALL questions

PART – A (10 x 1 = 10 MARKS)

1. The ratio of linear stress to linear strain is called _____.
2. The factor of safety for steel and for steady load is _____.
3. The maximum bending stress, in a curved beam having symmetrical section, always occur, at the _____.
4. Rankine's theory is used for _____.
5. Factor of safety for fatigue loading is the ratio of_____.
6. A bolt of M 24× 2means that _____.
7. A transmission shaft subjected to bending loads must be designed on the basis of _____.
8. The coefficient of fluctuation of speed is the _____ of maximum fluctuation of speed and the mean speed.
9. When helical compression spring is cut into halves, the stiffness of the resulting spring will be _____.
10. Two shafts A and B are made of the same material .The diameter of the shaft A is twice as that of shaft B. The power transmitted by the shaft A will be _____ of shaft B.

PART – B (5 x 3 = 15 MARKS)

11. How is factor of safety defined for brittle and ductile materials?
12. Define endurance limit. What are the factors affecting endurance strength?
13. What are differential and compound screws?
14. What are the purposes in machinery for which couplings are used?
15. What are the stresses involved in crank web?

PART – C (5 x 15 = 75 MARKS)

16. An unknown weight falls through 10 mm on a collar rigidly attached to the lower end of a vertical bar 3 m long and 600 mm^2 in section. If the maximum instantaneous extension is known to be 2 mm, what is the corresponding stress and the value of unknown weight? Take E = 200 kN/mm^2.

(OR)

17. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to i) Maximum Principal Stress theory ii) Maximum shear stress theory.

[P.T.O]

18. A round bar of diameter 40 mm has a smooth ground surface and is made of steel, for which the ultimate strength is 500 N/mm^2, yield strength is 400 N/mm^2 and endurance limit is 250 N/mm^2, Determine the factor of safety of the bar when it is subjected to alternating bending stress in a symmetric cycle. The maximum bending moment in the cycle is 640 Nm

(OR)

19. Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear intensity is 420 MPa and modulus of rigidity G = 84 kN/ mm^2.Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils.

20. Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 rpm. The angle of lap of the belt is 180^0 and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively .The allowable shear stress in the shaft may be taken as 35 MPa.

(OR)

21. Design a cast iron protective type flange coupling to transmit 15kW at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used:

    Shear stress for shaft, bolt and key materials = 40 MPa
    Crushing stress for bolt and key = 80 MPa
    Shear stress for cast iron = 8 MPa

    Draw a neat sketch of the coupling.

22. Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter; rivet pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 MPa respectively.

(OR)

23. Design and draw a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety= 6.

24. Design a cast iron piston for a single acting four stroke engine for the following data:
    Cylinder bore = 100mm; stroke = 125 mm; maximum gas pressure = 5 N/mm^2; Indicated mean effective pressure = 0.75 N/mm^2; Mechanical efficiency = 80 %; Fuel consumption = 0.16 kg per brake per hour; Higher calorific value of fuel = 42 X 10^3 kJ/kg; Speed =2000rpm.Any other data required for the design may be assumed. Also draw the piston with details

(OR)

25. A single cylinder double acting steam engine develops 150 kW at a mean speed of 80 rpm. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is ± 2% of mean speed. If the mean diameter of the flywheel rim is 2 m and the hub and spokes provide 5 % of the rotational inertia of the wheel, find the mass of the flywheel and cross sectional area of the rim. Assume the density of the flywheel material (which is cast iron) as 7200 kg/ m^3.