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**Question Paper Code : R 3776**

✓ B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fifth Semester

Mechanical Engineering

ME 331 — DESIGN OF MACHINE ELEMENTS

(Regulation 2001)

Time : Three hours

Maximum : 100 marks

Use of approved Data Book is permitted.

Assume appropriate design data wherever required and state them clearly.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Factor of safety.
2. What is stress concentration?
3. Give the efficiency of any four mechanical transmission elements.
4. List any four types of fits.
5. Sketch a stud.
6. Define welding.
7. Where are spline couplings used?
8. How is welding classified?
9. Why is I-section preferred for connecting rod?
10. List the uses of springs.

PART B — (5 × 16 = 80 marks)

11. (a) One helical spring is nested inside another: the dimensions are as tabulate below. Both the springs have same free length and carry a total load of 2500 N.

	Outer Spring	Inner Spring
No. of active coils	6	10
Wire diameter	12.5mm	9 mm
Mean coil diameter	100 mm	70 mm

Determine

- maximum load carried by each spring
- total deflection of each spring
- maximum stress in each spring.

Or

- (b) Discuss in detail the computer aided design and optimum design. State their relevance in designing mechanical elements. (8 + 8)

12. (a) Explain the important points to be observed while designing a part for easier machining and heat treating. (16)

Or

- (b) Discuss in detail the geometrical tolerance, interchangeable manufacture and selective assembly. (16)

13. (a) A socket type cotter joint is to be designed for a pull of 32 kN. A steel having the following maximum permissible stresses is used.

Permissible stress in tension = 56 N/mm<sup>2</sup>

Permissible stress in compression = 70 N/mm<sup>2</sup>

And Permissible stress in shear = 39 N/mm<sup>2</sup>

Take  $G = 83 \text{ Gpa}$ .

(16)

Or

- (b) A hole and shaft have a basic size of 25 mm and to have a clearance fit with maximum clearance of 0.02 mm and a minimum clearance of 0.01 mm./ the hole tolerance is to be 1.5 times the shaft tolerance. Determine the limits for both hole and shaft using (i) Hole basic system (ii) shaft basis system.

14. (a) Two bars are connected by a knuckle joint and the bars are subjected to a tensile load of  $F$ . List all the possible modes of failure and the governing relationship to determine the dimension of the elements.

Or

- (b) (i) The shaft of an axial flow rotary compressor is subjected to a maximum torque of 2 kNm and a maximum bending moment of a 4 kNm. The combined shear and fatigue factors in torsion and bending may be taken as 1.5 and 2.0 respectively. Determine the diameter of shaft, the shear stress in shaft should not exceed  $5.0 \text{ MN/m}^2$ . (8)
- (ii) Design a hollow shaft for the above compressor taking the ratio inner diameter to outer diameter as 0.5. Calculate the percentage saving in material and compare their stiffness. (8)
15. (a) Determine the dimensions of I-section at mid span of the connecting rod for a petrol engine of bore 110mm, stroke 150 mm, speed 1500 rpm, length of connecting rod is 325 mm, and explosion pressure is  $2.5 \text{ N/mm}^2$ . Select suitable material.

Or

- (b) Select a suitable ball bearing for a drilling machine spindle of diameter 40 mm rotating at 3000 rpm. It is subjected to a radial load of 2000 N and axial thrust of 1000 N. It is to work for 45 hours a week for one year.