

FACULTY OF ENGINEERING
B.E. 3/4 (M/P/AE) I- Semester Examination, July 2014

Subject : Design of Machine of Elements

Time : 3 Hours

Max. Marks: 75

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

- 1 Name various types of theories of failure and mention their applications.
- 2 Define the terms factor of safety and mention its importance in machine design.
- 3 Write short notes on S-N diagram.
- 4 What is Miner's rule?
- 5 Draw neat sketches of (i) Wood ruff key and (ii) Saddle Key
- 6 Mention the applications of Muff and Flexible Couplings.
- 7 Mention the applications of knuckle and cotter joint.
- 8 Name the factors to be considered in the design of gasket joints.
- 9 Distinguish between a differential and compound screws.
- 10 Classify different types of riveted joints and mention their applications.

PART – B (50 Marks)

- 11 A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment of 10kN-m and a torsional moment 30 kN-m. Determine the diameter of the shaft using two different theories of failure, and assuming a factor of safety of 2. Take $E = 210 \text{ GPa}$ and Poisson's ratio-0.25. (10)
- 12 A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a Central concentrated cyclic load having a minimum value of 20kN and a maximum value of 50kN. Determine the diameter of bar by taking factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by : Ultimate Strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. (10)
- 13 A steel shaft 1.25 m long, supported between bearings carries 1250 N pulley at its mid point. The pulley is keyed to the shaft and receives 20 kW at 200 rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600 mm. Compute the shaft diameter. (10)
- 14 Design a cotter joint to connect piston rod to the cross head of a double acting steam Engine. The diameter of the cylinder is 300 mm and the steam pressure is N/mm^2 . The allowable stresses for the material of cotter and piston rod are as follows:
 $\sigma_t = 50 \text{ MPa}$, $\sigma_c = 84 \text{ MPa}$ and $\tau = 40 \text{ MPa}$ (10)
- 15 Two mild steel tie bars for a bridge structure are to be joined by a double cover riveted butt joint. The thickness of the tie bar is 20 mm and carries a tensile load of 45 tonnes. Design the joint if the allowable stresses are : $f_t = 90 N/mm^2$, $f_s = 75 N/mm^2$, $f_c = 150 N/mm^2$. (10)
- 16 Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The following permissible stresses may be taken. Allowable shear stress for shaft, bolt and key material = 40 MPa. Allowable crushing stress for bolt and key = 80 MPa. Allowable shear stress for cast iron = 80 MPa. (10)
- 17 Write short notes on the following: (10)
 - (a) Manufacturing considerations in design
 - (b) Goodman's criteria
 - (c) Neat sketches of various types of key
 - (d) Caulking and Fullering in riveted joints