

**Government College of Engineering, Aurangabad**

(An Autonomous Institute of Government of Maharashtra)

**T.E.(Mechanical) P.T(Old)**

End Semester Examination Nov 2016- Semester I

**ME 301: Design of Machine Element-**

Time: Three Hours

15 NOV 2016

Max. Marks: 60

“Verify the course code and check whether you have got the correct question paper”

N.B.: -

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable data if necessary and state it clearly.
4. Use of Non-programmable Calculator is allowed.

**Q.1 Attempt any Two**

12

- a) Define factor of safety? Give the factors which are generally considered for design of machine parts? Which factors do you consider for designing ‘Computer chair’?
- b) Give different types of theories of failure and Explain any two with diagram and mathematical expressions.
- c) Draw stress strain diagram for ductile and brittle materials? Explain Why brittle materials design on basis of “Ultimate Strength” and ductile materials on basis of “Yield Strength”
- d) Give different types failures modes of material and explain each with example and neat diagram.
- e) Define Resilience, Toughness, Hardness, Creep, and explain impact, notch and fracture toughness with neat diagram
- f) Explain “Endurance Strength” with diagram and factors affecting on fatigue life of component?

**Q.2 Attempt any One**

12

- i) A socket & spigot joint subjected to loads varies from 5kN compressive to 8kN tensile. Design the all parts of joint to carry the loads safely. Give the details of failures. The material of all parts is SAE 1010 having ultimate strength 400 Mpa, shear strength 280 Mpa, compressive strength 350Mpa, and bending strength 300Mpa (Draw the diagrams of resisting areas under each failure).
- ii) A steel hollow shaft of outside diameter is twice inside diameter; transmitting 15kw at max 750 rpm is supported on two bearing 1.5 m apart and has two gears keyed to it. The pinion of 30 teeth and 5mm module is located at 300 mm right from left side bearing and drives power horizontally to the right shaft. The gear having 100 teeth and 5mm module is located at 200 mm left from right side bearing and receives power in vertical direction from below. The allowable shear stress for shaft material is 150Mpa. Determine the diameter of the shaft. (Assume suitable data if necessary and state it clearly)

**Q.3 Attempt any One**

12

- i) Calculate the maximum numerical normal stress and the maximum shear stress at section A-A in the member loaded as shown in figure no.1, If the circular section is 50x50 rectangular section find the max values of normal stress and the maximum shear stress at section A-A. Which section is best, give comment

- ii) Design and draw A knuckle joint connecting two shafts require transmitting maximum pull and push of 250kN and 200kN respectively. The joint is made from SAE1040 material and allowable stress in tension shear and compression are 150, 120, 140 MPa respectively. Draw all modes of failures with the resisting areas. (Assume suitable data if necessary and state it clearly)

**Q.4 Attempt any One**

12

- i) A circular bar of 700 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a 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. (Assume suitable data if necessary and state it clearly)
- ii) Design screw Jack to lift a load of 100 kN. The unsupported length of screw is 50cm, the screw is made up of SAE 1045 material of ultimate tensile strength 500Mpa and nut is of SG 400 CI of ultimate tensile strength 350Mpa, permissible bearing pressure is  $10\text{N/mm}^2$ , The length of handle is 200cm, Check screw and nut for different failures? (Assume suitable data if necessary).

**Q.5 Attempt any One**

12

- i) A 50 mm rectangular bar is welded as a cantilever beam by means of fillet weld all around to a flat plate at centre. The plate size is  $0.5\text{m} \times 0.5\text{m}$  & 10 mm thick. It is subjected to a load of 3kN at its end, determine the size of weld if the permissible Max. shear stress and Max Normal stress in the weld is limited to 60Mpa and 100 Mpa respectively
- ii) Write detail notes on (any two) [ on basis Contents, International designations and Applications]
- Alloy steel
  - Low carbon steel, Medium carbon steel, and High carbon steel-
  - Tool Steel
  - Soderberg, Goodman and Gerber criterion of failure

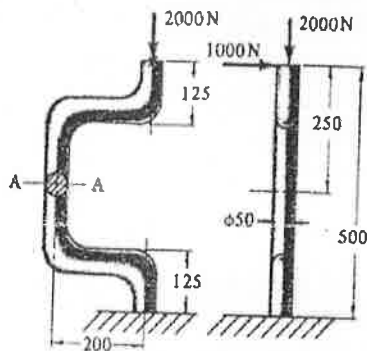


Figure: 1 [Q.N. 3(i)]