Q.P. Code: 16ME314 R16

Reg. No: | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

**B.Tech III Year I Semester Supplementary Examinations December-2021**

**DESIGN OF MACHINE ELEMENTS– I**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 60

(Answer all Five Units **5 x 12 = 60** Marks)

**UNIT-I**

| | | | | |
|---|---|---|---|---|
| 1 | a | Explain the general design procedure while designing a machine element. | L1 | 6M |
| | b | Derive an expression for the impact stress induced due to a falling load. | L2 | 6M |

**OR**

| | | | | |
|---|---|---|---|---|
| 2 | a | What is meant by factor of safety? Explain how it can be used in design applications. | L2 | 6M |
| | b | Draw the stress –strain diagram for mild steel. Explain. | L3 | 6M |

**UNIT-II**

| | | | | |
|---|---|---|---|---|
| 3 | | Explain Goodman's and Soderberg's and Gerber's parabola equation for combination stresses. | L2 | 12M |

**OR**

| | | | | |
|---|---|---|---|---|
| 4 | | 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 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 bars are given by: ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. 12M | L4 | 12M |

**UNIT-III**

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|---|---|---|---|---|
| 5 | a | What is the difference between caulking and fullering? Explain with the help of neat sketches | L2 | 6M |
| | b | A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. If the above joint is subjected to a load such that the factor of safety is 4, Find out the actual stresses developed in the plates and the rivets. | L3 | 6M |

**OR**

| | | | | |
|---|---|---|---|---|
| 6 | a | What are the assumptions made in the design of welded joint? | L2 | 6M |
| | b | What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint | L3 | 6M |

**UNIT-IV**

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| 7 | | 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. | L3 | 12M |

**OR**

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|---|---|---|---|---|
| 8 | Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses : $\sigma t$= 60 MPa ; $\tau$ = 70 MPa ; and $\sigma c$ = 125 MPa. | L3 | 12M |

**UNIT-V**

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|---|---|---|---|---|
| 9 | **a** | What is a key? State its function with neat sketch. | L2 | 6M |
| | **b** | A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2. | L3 | 6M |

**OR**

| | | | | |
|---|---|---|---|---|
| 10 | | Design a cast iron protective type flange coupling to transmit 15 kW at 900r.p.m. 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 material = 40 MPa; Crushing stress for bolt and key = 80 MPa; Shear stress for cast iron = 8 MPa Draw a neat sketch of the coupling. | L3 | 12M |

*** END ***