**Q.P. Code: 16ME314** **R16**

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

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**

(AUTONOMOUS)

**B.Tech III Year I Semester Regular Examinations November/December 2018**

**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 design process with a flow chart? 6M

**b** A propeller shaft for a launch transmits 75 KW at 150 rpm and is subjected to a maximum bending moment of 1KN-m and an axial thrust of 70 KN. Find the shaft diameter based on maximum shear stress if the shear strength of the shaft material is limited to 100 MPa? 6M

**OR**

**2** **a** State and explain different types of designs? 5M

**b** The brasses of an automobile engine connecting rod have worn-out so as to allow some play which gives shock loading, equivalent to a weight of 6 kN, falling through a height of 0.2 mm. The connecting rod is 250 mm long having cross sectional area of 300 $mm^2$. Determine the stress induced in the connecting rod? Assume E= 2.1 X $10^5$ 7M

**UNIT-II**

**3** **a** Name different types of cyclic stresses? 2M

**b** A spherical vessel, with 500 mm inner diameter, is welded from steel plates. The welded joints are sufficiently strong and do not weaken the vessel. The plates are made from cold drawn steel with ultimate stress 440 MPa, endurance limit 220 MPa. The vessel is subjected to internal pressure, which varies from 0 to 6 MPa. The expected reliability is 50% and the factor of safety is 3.5. The vessel is expected to withstand infinite number of stress cycles. Calculate the thickness of the plates? Asuume $K_a = 0.82$, $K_b = 0.85$. 10M

**OR**

**4** **a** Explain low and high cycle fatigue curves for steel material? 5M

**b** A machine component is subjected to fluctuating stress that varies from 40 to 100 MPa. The corrected endurance limit stress for the machine component is 270 MPa. The ultimate tensile strength and yield strength of the material are 600 and 450 MPa respectively. Find the factor of safety using

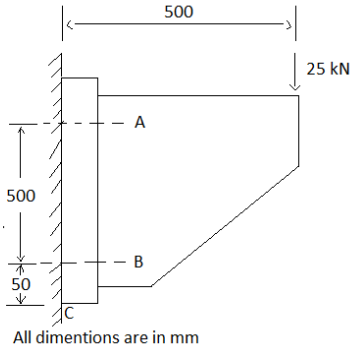
i. Gerber theory
ii. Soderberg line
iii. Goodman line
iv. Also find the factor of safety against static failure? 7M

**UNIT-III**

**5** **a** Discuss different type's welded joints? 2M

**b** A wall bracket is attached to a wall by means of four identical bolts, two at A and two at B as shown in figure. Assuming that the bracket is held against the wall and prevented from tipping about C by all four bolts and using an allowable tensile stress on the bolts as 35 MPa,

Determine the size of the bolts on the basis of maximum principal stress theory? 10M




**OR**

**6** **a** Derive the relations for strength of parallel and transverse fillet welds? 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. 6M

**UNIT-IV**

**7** **a** Design and draw the knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. The rods and cotter is made of plain carbon steel with the allowable stresses $\sigma_t$ = 80 MPa, $\sigma_c$ = 80 MPa, $\tau$ = 40 MPa. 12M

**OR**

**8** **a** A shaft, supported by two bearings 800 mm apart, transmits 600 kW at 1000 rpm. A vertical load of 400 N acts at the mid-span of the shaft. Design the shaft for the following permissible values
Case i Permissible shear stress= 40 MPa
Case ii Permissible lateral deflection = 0.025 mm
Case iii Permissible angular deflection = $1^o$ for every 15 diameters 12M

**UNIT-V**

**9** **a** Design a clamp coupling for transmitting 36 kW, at 200 rpm. Allowable shear stress in shaft is 45 MPa, allowable shear stress in key is 40 MPa, and allowable crushing stress in key is 90 MPa. The number of bolts joining the two halves is 4. The permissible tensile stress in bolts is 60 MPa. The coefficient of friction between the muff and shaft can be taken as 0.25 7M

**b** The standard cross section for a flat key, which is fitted on a 50 mm diameter shaft, is 16 x 10 mm. The key is transmitting 475 N. m torque from the shaft to the hub. The key is made of commercial steel with shear and crushing stresses are 115 MPa and 230 MPa respectively. Determine the length of the key, if the factor of safety is 3 5M

**OR**

**10** Design and draw a protected –type rigid, CI flange coupling, to transmit 16 kW at 1000 rpm from an electric motor to a compressor. Service factor for electric motor with compressor can be taken as 1.4. The following allowable stresses can be taken.
Shear stress in shaft, bolt and key = 40 MPa
Crushing stress for bolts and key = 70 MPa
Shear stress hub = 10 Mpa 12M

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