B.E. METALLURGICAL AND MATERIAL ENGINEERING SECOND YEAR FIRST SEMESTER EXAMINATION 2019

MACHINE DESIGN AND DRAWING

Time: **Three hours**   Full Marks: **100**

Missing data, if any, are to be reasonably chosen. Give sketches wherever applicable.

Answer **Question No 1** and any **three (03)** from the rest

1. a) Discuss significance of factor of safety in design. b) Discuss significance of failure theories in design. c) What are the purposes of the rubber bush and brass lining in bushed-pin flexible coupling? d) Show that for thin cylinder subjected to internal pressure, the tendency to burst lengthwise is twice as great as transverse section. e) Justify the statement: Generally, the cross section of the pulley arm is elliptical and the major axis of the arm is placed in the plane of rotation. f) What is/are the purpose(s) of using spigot and recess in rigid type flange coupling? g) In a horizontal flat belt drive, generally, which side is made the tight side and why? h) Discuss the procedure of Shaft design following ASME code. i) Discuss the designation procedure of steels.

$$[03+03+03+03+03+02+03+04+04]=28$$

2. a) A solid circular shaft made of steel (tensile strength= 610 MPa, yield stress= 340 MPa) is subjected to an alternating torsional moment which varies from -300 N-m to +550 N-m and at the same time shaft is subjected to a bending moment that varies from +100 N-m to +260 N-m. Calculate the shaft diameter using Gerber parabola and Goodman line considering the following data: Factor of safety=2.5, Corrected endurance limit= 175 MPa.

b) A rotating bar made of steel (σ_{ut} = 600 N/mm^2) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 275 MPa. Calculate the fatigue strength of the bar for a life of 90000 cycles.   *[14+10]*

3. a) A steel plate is subjected to a load of 12 kN and fixed to a channel by means of 3 identical bolts as shown in Fig. Q3. Material of bolts is C30 C.S (σ_y=340 N/mm^2) and F.S is 3. Determine the nominal dia. of the bolts. Neat sketch of the force diagram should be drawn.
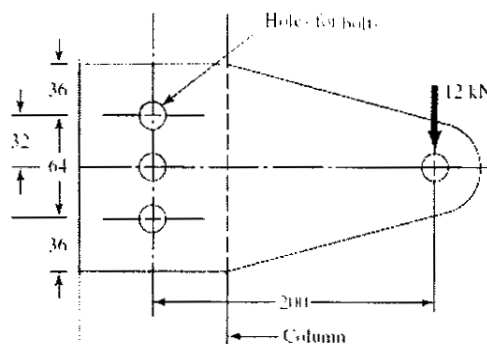

Fig. Q3

b) Two mild steel bars having 400 mm width and 25 mm thickness, are to be connected by means of Lozenge joint with two straps. Design and sketch the joint if the permissible stresses are: σ_t=90 MPa, σ_c=110 MPa, σ_s=70 MPa.   *[12+12]*

4. a) Design a socket and spigot type cotter joint to transmit an axial load of 130 kN. All components are made up of plain carbon steel. The allowable stresses are 150 MPa in tension, 87 MPa in shear and 240 MPa in crushing. Also draw a neat sketch of the joint. b) Find the maximum condition for power transmission in belt pulley drive.   *[20+04]*

5. a) Design and draw a protective type rigid shaft coupling to transmit a rated load of 93 kW at 750 rpm. Also the shaft is subjected to a bending moment of 150 N-m. Allowable shear and crushing stresses in the shaft and key are 60 N/mm^2 and 115 N/mm^2 respectively. Allowable shear stress of the coupling bolt material is 56 N/mm^2 and allowable shear stress of CI flange is 62 N/mm^2. b) Discuss the applicability of Lame's, Clavarionos and Birnie's equations.   *[20+04]*