EX/MET/MDD/ME/T/1/215/2017(S)

B. MET. ENGG. 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION 2017

Subject: MACHINE DESIGN AND DRAWING **Time: THREE HOURS** **Full Marks: 100**

Missing data, if any, are to be reasonably chosen.
Give sketches wherever applicable.
Answer any **Five (05)** Questions

1. Write short notes on (any four)

a) Shaft design based on strength and rigidity, b) Theories of failures in design, c) Endurance limit modifying factors, d) Failures of a riveted joint and e) Effects of belt speed on power transmission in a belt drive. *5×4*

2. Design and draw a rigid type shaft coupling to transmit a rated load of 65 kW at 450 rpm. Assume 10% overload and the load is applied with minor shock. Also the shaft is subjected to a bending moment of 100 N-m. Allowable shear and crushing stresses in the shaft and key are 65 N/mm^2 and 120 N/mm^2 respectively. Allowable shear stress of the coupling bolt material is 60 N/mm^2 and allowable shear stress of CI flange is 62 N/mm^2. Use of standard proportions is desirable. *20*

3. Design a cotter joint for transmitting an axial load of 120 kN. Use C-30 CS (σ_t =340 N/mm^2 & σ_{ut} = 530 N/mm^2). Take a suitable factor of safety. *20*

4. a) A solid circular shaft made of steel (tensile strength= 600 MPa, yield stress= 370 MPa) is subjected to an alternating torsional moment which varies from -350 N-m to +600 N-m and at the same time shaft is subjected to a bending moment that varies from +120 N-m to +400 N-m. Calculate the shaft diameter using the following data: corrected endurance limit=210 MPa, Factor of safety=2.5. *12*

b) Deduce the expressions for belt lengths considering open belt and crossed belt arrangements. *08*

5. a) Deduce the expressions for circumferential, longitudinal and radial stresses for a thick cylinder subjected to an internal pressure and show the variations of principal stresses. Considering maximum principal stress theory of failure, find out the expression for cylinder wall thickness. *14*

b) Discuss slip and creep in connection with belt drive. *06*

6.a) Design a flat belt pulley made of grey cast iron FG 200. The arms are of elliptical cross section, in which the major axis is twice the minor axis. The tensions on the tight and slack sides of the belts are 6000 and 2500 N respectively and the design power is 39 kW. The diameter of the pulley is 600 mm and the shaft diameter is 56 mm. Use of standard proportions is desirable. *12*

b) A rotating bar made of plain carbon steel (Tensile strength: 630 MPa) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 315 MPa. Calculate the fatigue strength of the bar for a life of 90,000 cycles. *08*