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FIFTH SEMESTER

**B.Tech (ME)**

**END SEMESTER EXAMINATION (Supplementary) Feb -2019**

**ME305 & Design of Machine Elements**

*Time: 3:00 Hours*

*Max. Marks : 40*

**Note :** Answer any five questions.

All questions carry equal marks. Assume suitable missing data, if any. Design Data H/Book is allowed

- Q.1[a] Explain the procedure for selection of factor of safety for a connecting rod. [2]
- [b] What are the factors responsible for selection of materials for a machine component? [2]
- [c] Explain distortion energy theory of failure. [2]
- [e] How localised stresses in machine component be avoided? Explain with diagrams. [2]

Q.2 A long thin pressure vessel of AISI1020 (Yield stress 350MPa) with 70mm internal diameter and 2.5mm thick is subjected to an internal pressure of 6MPa. If the cylinder is also subjected to a twisting moment of 70Nm, determine the factor of safety on the basis of Maximum Principal stress, Maximum shear and Distortion energy theory. Which theory of failure is better for this design? [8]

Q.3 A steel shaft of AISI1030 is subjected to a torsional moment that varies from 330 Nm clockwise to 110 Nm counter-clockwise and an applied bending moment at a critical section varies from +440 Nm to -220 Nm. The shaft is of uniform cross-section and no keyway is present at

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the critical section. Determine the required shaft diameter using Goodman and Soderberg criteria. The material has an ultimate strength of 550 MPa and a yield strength of 410 MPa. Take the endurance limit as 0.5 times the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62. [8]

Q.4 Design a simple cotter joint for an axial load of 100kN. Assume that all the parts are made of same material with permissible stresses of 70MPa, 50MPa and 90MPa in tension, shear and compression respectively. [8]

Q.5 A pair of spur gears is to transmit 20kW. The teeth are  $15^\circ$  full depth involute. The Cast steel pinion ( $\sigma_o=150\text{MPa}$ ) is to drive a cast iron gear ( $\sigma_o=55\text{MPa}$ ) at 450 r.p.m., and the velocity ratio is 1:3. If the pinion is surface hardened to 270BHN determine the proper module, number of teeth and face width for these gears from the standpoint of strength, dynamic load and wear. Assume a first class commercial gear having an error of 0.07mm for which  $C=283\text{kN/m}$ . [8]

Q.6 Design a Bush-pin type flexible coupling for transmission of 30kW from a motor to a centrifugal pump at 1448rpm. The following data is given: Diameter of motor shaft=38mm, Diameter of pump shaft=30mm, No. Of bolts=6 nos. Allowable Shear stress for the bolts, keys and shaft=55MPa, Allowable shear stress for the flanges=12MPa. Assume crushing stress twice the shearing stress in all cases. [8]

Q.7 Design a triple riveted butt joint with zig-zag fashion with five rivets in one pitch length and with double cover plates of equal widths for a boiler drum. The thickness of the main plate is 15mm. The allowable tensile stress, compressive stress and shearing stress of the steel used are 75MPa, 100MPa and 58MPa respectively. The efficiency of the joint should not be less than 75%. Assume that the boiler plate and rivets are made of the same steel. [8]

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