

V SEMESTER B.TECH. (MECHANICAL ENGINEERING) END SEMESTER EXAMINATIONS, NOV 2017

SUBJECT: MECHANICAL DESIGN- I [MME 3102]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data, if any, may be suitably assumed.
- Use of Machine design data hand book is permitted.
- 1A. A mild steel bracket shown in Fig. Q1A is subjected to a pull of 10 kN. The (05) bracket has a rectangular cross-section whose width is half the height. If the yield strength of the material is 240 MPa, determine the cross-section of the bracket. Take factor of safety of 3.
- 1B. A C45 Carbon steel cylindrical shaft of outer diameter double the inner (03) diameter is subjected to a bending moment of 15000 Nm and torque of 25000 Nm. Find the dimensions of shaft using maximum shear stress theory. Take factor of safety of 2.
- **1C.** Define the following
 - a. Stress concentration factor
 - b. Endurance limit
- 2A. A circular rod shown in Fig. Q2A of diameter 1.3d has a semicircular groove (05) of diameter 0.2d. This rod is to sustain a torque that varies from 1 kNm to 2 kNm together with a bending moment that varies from -1.5 kNm to 2.5 kNm. Determine the diameter of the rod as per maximum shear stress theory. Assume q = 1 and surface finish factor as 0.85. Take σ_{yp} = 350 MPa, σ_{en} = 225 MPa and a factor of safety of 3.
- **2B.** With the help of assumptions derive an expression for stress distribution due **(05)**

(02)

to bending moment in a curved beam.

- **3A.** A steel solid shaft transmitting 15 kW at 200 rpm is supported on two **(08)** bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right as seen from the left hand bearing. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing, rotates clockwise as seen from the right hand bearing and receives power in a vertical direction from below. Using an allowable shear stress of 50 MPa and considering steady loading conditions, determine the diameter of the shaft. Draw the horizontal, vertical and resultant bending moment diagrams.
- **3B.** Explain the crushing failure in a key with a neat sketch. (02)
- **4A.** With neat sketches discuss the different types of failures in riveted joints **(05)**
- **4B.** A rectangular bar is welded to the support as shown in Fig. Q4B. The **(05)** allowable shear stress is 100 N/mm². Determine the size of the weld.
- **5A.** A bracket for supporting the travelling crane is shown in Fig. Q5A The **(05)** bracket is fixed to the steel column by means of four identical bolts, two at A and two at B. The bolts are made of steel 40C8 (σ_{yp} = 380 N/mm²) and the factor of safety is 5. Determine the size of the bolt.
- 5B. A power transmission screw having a single start square thread with a (05) nominal diameter of 36 mm and pitch 6 mm propels a weight of 25 kN at a speed of 4 m/min. The collar has a mean diameter of 45 mm. The coefficient of friction at thread is 0.15 and the coefficient of friction at the collar is 0.12. Determine:
 - (i) The power of motor required to drive the screw
 - (ii) The efficiency
 - (iii) Length of bronze nut required if the allowable bearing pressure is 12 MPa
 - (iv) Length of lever, if a force of 300 N is exerted at the end of the lever







Fig. Q1A

→ 100 **→**

t

100

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Fig. Q4B

200 -





10 kN