Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

V SEMESTER B.TECH. (MECHANICAL ENGINEERING)
END SEMESTER MAKE-UPEXAMINATIONS, DEC-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 Plain carbon steel bar with 0.55% carbon and 0.8% manganese is subjected to an axial tensile load of 40 kN and torsional moment of 16×10^5 Nmm. Determine the diameter of steel bar using maximum shear stress theory and distortion theory. Take factor of safety of 1.5 **(05)**

1B. Define factor of safety and list any two factors influencing the selection of factor of safety. **(02)**

1C. A round rod of radius 0.6*d* has a semicircular groove of diameter 0.2*d*. The rod is subjected to a bending moment of 10 kNm. The material of the rod is C30 steel. Determine a safe value of 'd'. Take factor of safety of 2. **(03)**

2A. Explain different types of cyclic stresses with the help of neat sketches. **(05)**

2B. Determine the load acting on the frame of a punch press shown in Fig. 2B. The material from which the frame is made has an allowable stress of 80 N/mm^2 along the section A-B. **(05)**

3A. A commercial turned steel shaft is mounted between 2 bearings located 1.5 m apart. A pinion of pitch circle diameter 0.4 m is keyed to the shaft 0.45 m to the right of the left bearing. A pulley is keyed to the shaft 1 m to the left of the right bearing. The pulley receives power of 12 kW at 200 rpm from a motor by a belt drive inclined at an angle of 30^0 below the horizontal to the left as seen from the left bearing. The pinion drives another gear mounted to the right of it as seen from the left bearing such that the tangential force acting on pinion is vertically upwards. The gears have 200 involute tooth form. The sum of the belt tensions is 5730 N. The weight of the pinion and pulley are 200 N and 300 N respectively. Determine the diameter of the shaft considering gradually applied load. **(07)**

3B. State the ASME code guidelines for the design of shaft. **(03)**

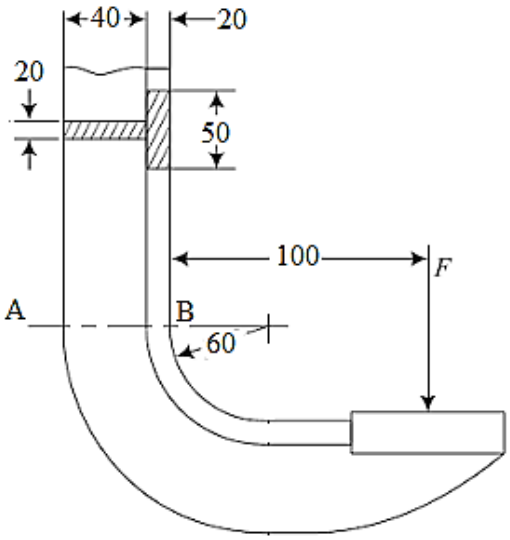
4A. A double riveted butt joint is to be made to connect two plates 20 mm thick. The joint is zig-zag riveted and has equal width cover plates. The allowable tensile stress for the plate is 100 MPa. The allowable shear and crushing stresses for rivet material are 60 MPa and 120 MPa respectively. Sketch the joint and find i) pitch ii) least strength. **(05)**

4B. Sketch and explain the following in case of fillet weld. **(03)**
i) leg size ii) throat of weld

4C. State the advantages and disadvantages of welded joints over riveted joints. **(02)**

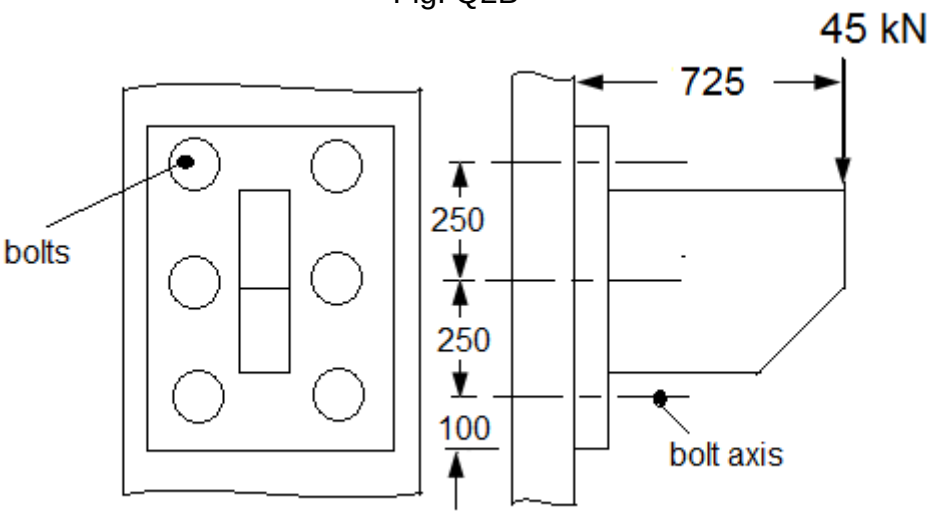
5A. A square threaded power screw has a nominal diameter of 44 mm and a pitch of 7 mm with double start threads. The load on the screw is 6 kN and mean diameter of the collar is 30 mm. Coefficient of friction for thread and collar is 0.12. Determine: **(05)**
(i) Torque required to raise the load
(ii) Torque required to lower the load
(iii) Efficiency and
(iv) Is the screw self-locking?

5B. A bracket is subjected to a transverse load of 45 kN as shown in Fig. Q5B. The allowable normal stress for the bolt material is 135 MPa. Determine the suitable diameter of the bolts to be used. **(05)**



All dimensions in mm

Fig. Q2B



All dimensions in mm

Fig. Q5B