MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

V SEMESTER B. TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: MECHANICAL DESIGN - I [MME 3102]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- Use of Design data hand book is permitted
- A shaft simply supported at ends carries a load W at the centre, as shown in (05)
 Fig.Q.1A. Determine the magnitude of the load such that the stresses due to bending moment will not exceed 250 MPa.
- 1B. The dimensions of an overhang crank are given in Fig.Q.1B.The force P (05) acting at the crankpin is 1 kN. The crank is made of steel with yield strength of 400 MPa and the factor of safety is 2. Using maximum shear stress theory, determine the diameter d at the section X-X.
- **2A.** What do you mean by low cycle fatigue and high cycle fatigue? Give two **(03)** examples for each.
- **2B.** Why endurance limit of an axially loaded specimen is lesser than that for a **(02)** rotating beam specimen?
- 2C. The C-frame of a 100 kN capacity press is shown in Fig.Q.2C. The material of (05) the frame is grey cast iron FG 200 and the factor of safety is 3. Determine the dimensions of the frame.
- **3A.** A steel solid shaft transmitting 15 kW at 200 rpm is supported on two 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. Assume the pressure angle as 20⁰.

- **3B.** Briefly explain feather key with a neat sketch. (03) 4A. A double riveted lap joint is used for joining two plates of thickness 10 mm. (03) The allowable stresses are $\sigma_t = 60 MPa$, $\sigma_c = 80 MPa$ and $\tau = 50 MPa$. Sketch the joint and determine (i) Pitch (ii) Overlap (02)
- 4B. Define (a) Tranverse pitch (b) Margin
- 4C. A 10 mm thick steel plate is welded to a vertical support using four 6 mm fillet (05) welds as shown in Fig.Q.4C. Find the safe load P if permissible shear stress in the weld material is 75 MPa.
- A bracket is fastened to the steel structure by means of six identical bolts as 5A. (05) shown in Fig.Q.5A. Determine the size of the bolts, if the maximum permissible tensile stress in any bolt is limited to 100 N/mm².
- 5B. State three differences between square thread and trapezoidal thread. (03)
- 5C Define (a) Lead (b) Helix angle



All dimensions in mm

Fig.Q.1A

(02)



All dimensions in mm

Fig.Q.1B



(a)



All dimensions in mm









All dimensions in mm

Fig.Q.5A