

Roll No.

Total No. of Pages : 03

Total No. of Questions : 09

**B.Tech. (ME) (Sem-5)**  
**DESIGN OF MACHINE ELEMENTS**

Subject Code : BTME-502-18

M.Code : 78248

Date of Examination : 12-06-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

**1. Write briefly :**

- a) Define the term shearing.
- b) Define the term endurance limit.
- c) Define the terms bearing - characteristic number and bearing modulus for journal bearing.
- d) What is rated life of a ball bearing?
- e) What are the advantages of worm gear drive?
- f) What is creep in belts?
- g) What is the objective of nipping of leaf spring?
- h) Why is heat dissipation necessary in clutches?
- i) What are the advantages of disk brakes over drum brakes?
- j) What is leg and throat thickness of a fillet weld?

## SECTION-B

2. Explain the procedure used to design a machine element.
3. Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows: Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa.

The factor of safety based on yield point may be taken as 1.5.

4. Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5.
5. Explain the procedure used to design a chain drive.
6. A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm<sup>2</sup>. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear.

## SECTION-C

7. Design a journal bearing for a centrifugal pump from the following data : Load on the journal = 20,000 N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg/m-s; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N/ mm<sup>2</sup>. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m<sup>2</sup>/°C.
8. A spur gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth has 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear.

9. Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 r.p.m. The overall torque is 20 percent more than mean torque. The material properties are as follows :
- The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.
  - The allowable shear stress for cast iron is 15 MPa.
  - The allowable bearing pressure for rubber bush is  $0.8 \text{ N/mm}^2$ .
  - The material of the pin is same as that of shaft and key.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**