

Sixth Semester B.E. Degree Examination, July/August 2022

**Design of Machine Elements – II**

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

**Module-1**

- 1 a. Derive an expression for the shear stress induced in a helical compression spring, with usual notations. (10 Marks)
- b. A helical valve spring is to be designed for an operating load range of approximately 90 to 135 N. The deflection of the spring for the load range is 7.5 mm. Assume a spring index of 10 and factor of safety = 2. Design the spring. (10 Marks)

OR

- 2 a. Design a single plate clutch consist of two point of contacting surfaces for a torque capacity of 200 Nm. Due to space limitations the outside diameter of the clutch is to be 250 mm. (10 Marks)
- b. A single block brake shown in Fig. Q2 (b). The drum diameter is 250 mm. The contact angle is  $90^\circ$ . If an operating force of 700 N is applied at the end of the lever and the co-efficient of friction is 0.35 determine the torque that may be substituted by the brake. (10 Marks)

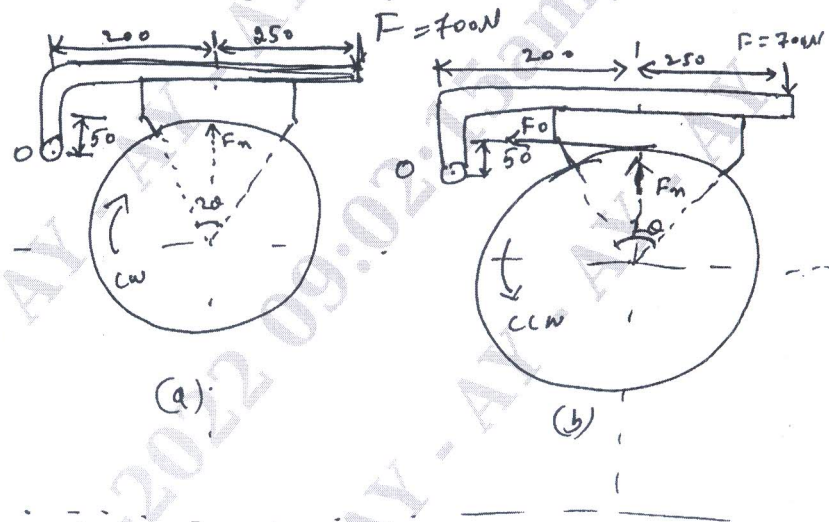


Fig. Q2 (b)

**Module-2**

- 3 Design a pair of spur gears to transmit a power of 18 kW from a shaft running at 1000 rpm to a parallel shaft to be run at 250 rpm maintaining a distance of 160 mm between the shaft centres. Suggest suitable surface hardness for the gear pair. (20 Marks)

OR

- 4 A pair of bevel gear wheels with  $20^\circ$  pressure angle consist of 20 teeth pinion meshing with 30 teeth gear. The module is 4 mm while the face width is 20 mm. The surface hardness of both pinion and gear is 400 BHN. The pinion rotates at 500 rpm and receives power from an electrical motor. The starting torque of the motor is 150 percent of the rated torque. Determine the safe power that can be transmitted considering the dynamic load, wear strength and endurance strength. The allowable bending stress may be taken is 240 MPa. (20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

**Module-3**

- 5 a. Sketch and explain theory of hydrodynamic lubrication. (10 Marks)  
 b. Explain the following :  
 (i) Bearing characterization.  
 (ii) Bearing modulus.  
 (iii) Sommerfield number. (10 Marks)

**OR**

- 6 a. Mention types of bearings and also explain the properties of lubricants. (10 Marks)  
 b. What are the advantages and disadvantages of ball and roller bearings? (10 Marks)

**Module-4**

- 7 a. Explain the function of piston and piston rings. (08 Marks)  
 b. Design a cast iron piston for a single acting four stroke engine for following specifications:  
 $D = 100 \text{ mm}$ ,  $L = 125 \text{ mm}$ ,  $P_{\max} = 5 \text{ N/mm}^2$ ,  $\text{BMEP} = 0.5 \text{ N/mm}^2$ , fuel consumption  $0.25 \text{ kg/kw/hr}$ , Speed = 2000 rpm. Assume data if necessary. (12 Marks)

**OR**

- 8 Explain the following:  
 (i) Sodium cooled valve.  
 (ii) Valve guides.  
 (iii) Push rods.  
 (iv) Rocker arm (20 Marks)

**Module-5**

- 9 a. Determine the cross section dimension of a rectangular section connecting rod length of connecting rod = 400 mm. Maximum gas load = 20 kN permissible compressive stress for the connecting rod material =  $100 \text{ N/mm}^2$ . (12 Marks)  
 b. Sketch and explain the Buckling effect of connecting rod. (08 Marks)

**OR**

- 10 a. With a neat sketch, explain the oil holes drilled in crank shaft. (12 Marks)  
 b. Sketch and explain vibration dampers with respect to crank shaft. (08 Marks)

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