

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Eighth Semester B.Tech Degree Supplementary Examination August 2021

**Course Code: ME 402****Course Name: Design of Machine Elements-II**

Max. Marks: 100

Duration: 3 Hours

*Use of approved design data book is permitted  
Missing data may be suitably assumed*

**PART A***Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) A multi plate clutch having effective diameters 250 mm and 150 mm has to transmit 60 kW at 1200 rpm. The end thrust is 4.5 kN and coefficient of friction is 0.08. Calculate the number of disks assuming (i) uniform wear condition and (ii) uniform pressure condition. (12)
- b) Differentiate between self locking and self energizing block brakes. (3)
- 2 a) Design a journal bearing to sustain a load of 6 kN over a shaft diameter of 50 mm. The operating speed of the shaft is 1000 rpm and the operating temperature is 50°C. Design the bearing with indication of artificial cooling? (12)
- b) With the help of neat sketches illustrate the working principle of hydrodynamic journal bearings. (3)
- 3 a) A deep groove ball bearing supporting a radial load of 100 kgf is to have a design life of 20 hrs with only 5 % probability of failure. The speed of rotation is 4000 rpm. Using the service factor of 1.8 choose a bearing. (12)
- b) Enumerate any two advantages and disadvantages of rolling contact bearing over sliding contact bearing. (3)

**PART B***Answer any two full questions, each carries 15 marks.*

- 4 Design a spur gear drive required to transmit 15 kW at 800 rpm of the pinion. The speed ratio is 3.2:1. Use 20° full depth involute system. Check the gear pair for safe endurance strength and surface durability based on the calculation of dynamic load from Buckingham's equation. (15)
- 5 A pair of helical gears with 23° helix angle is to transmit 12.5 kW at 1600 rpm of the pinion at a velocity ratio of 4:1. Both gears are to be made of hardened steel, (15)

with an allowable stress of  $109.87 \text{ N/mm}^2$ . Use  $20^\circ$  involute system for the gear pair. Design the gear pair and check the design against safety also.

- 6 The vertical spindle of a drilling machine is to be driven by a pair of right angled bevel gears with  $20^\circ$  involute teeth. The speed reduction is 3:1. The drill requires a power of 15 HP at 500 rpm. A service factor of 1.15 may be taken and select suitable materials for gear and pinion. Design the gear pair and check its safety. (15)

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) A thick walled closed end cylinder has internal and external diameter as 200 mm and 800 mm. The cylinder is subjected to an internal fluid pressure of 150 MPa. If  $E = 72 \text{ GPa}$  and Poisson's ratio  $\mu = 0.33$ , determine the principle stresses and maximum shear stress. Also find the increase in internal diameter due to the fluid pressure. (8)
- b) Design a connecting rod for an IC engine using the following data, Diameter of the piston = 140 mm, Stroke = 160 mm, Weight of reciprocating parts = 3 kg, Length of the connecting rod = 400 mm, Maximum speed = 2000 rpm, Maximum explosion pressure = 2.25 MPa. Maximum allowable bearing pressure at small end and big end are 15 MPa and 10 MPa respectively. Assume the density of material as  $8000 \text{ kg/m}^3$ . Assume also the allowable stress in bolt and cap as  $60 \text{ N/mm}^2$ . (12)
- 8 a) Select a V belt drive to connect a 15 kW, 2880 rpm motor to a centrifugal pump, running approximately 2400 rpm for a service of 18 hours per day. Centre distance is approximately 400 mm. Assume the pitch diameter of the driving pulley as 125 mm. (17)
- b) What is the effect of centrifugal tension on power transmission by a belt drive? (3)
- 9 a) A 800 rpm, 25 kW squirrel cage induction motor is to drive a reciprocating pump at 200 rpm. The pump is to run at full load for 24 hours a day. Select a suitable roller chain drive if the centre distance is as short as possible. (15)
- b) What is the polygonal action in roller chain? How will you reduce it? (5)

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