



R18 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

Subject code: 2P6CA

B.Tech VI Semester Regular/Supplementary Examinations, June 2022

DESIGN OF MACHINE MEMBERS – II

(Mechanical Engineering)

Maximum Marks: 70

Date: 18.06.2022 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
 3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 What is meant by bearing modulus and boundary lubrication?
- 2 How is equivalent static load and equivalent dynamic load is acting in bearings?
- 3 Distinguish between rolling contact bearings and sliding contact bearings?
- 4 Define the term bearing life. Show its mathematical equation?
- 5 Why various stresses induced in the connecting rod?
- 6 What is meant by whipping of a connecting rod and what is its effect.
- 7 What are the applications of flat belt drives?
- 8 List the classification of springs?
- 9 Define (i) Load concentration factor and (ii) Dynamic load factor with respect to spur gears
- 10 What is meant by wear load of a gear tooth?

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 a) A 3 kN load is supported by a journal bearing of 75 mm diameter and 75 mm length. Diametric clearance 0.05 mm and bearing is lubricated by the oil of 0.0207 paS viscosity at operating temperature. Determine the maximum speed of rotation of bearing when it is capable of dissipating 80 watts by heat transfer
b) Differentiate between hydrostatic and hydro dynamic bearing? What is the importance of McKee's investigation? [5+5]

OR

- 12 A Journal bearing with a diameter of 200 mm and length 150 mm carries a load of 20 kN when the journal speed is 150 rpm. The diametric ratio is 0.0015. If possible, the bearing is to operate at 350 ambient temperatures without external cooling with a maximum oil temperature of 90° C. If external cooling is required, it is to be little as possible to minimize the required oil flow rate and heat exchanger size. i) What type of oil do you recommend? ii) Will the bearing operate without external cooling? iii) If the bearing operates without external cooling, determine the operating oil temperature. iv) If the bearing operates with external cooling, determine the amount of oil in kg/min required to carry away the excess heat generated over heat dissipated, when the oil temperature rises from 95° C to 105° C, when passing through the bearing. [10]

- 13 a) A bearing, 60 mm in diameter and 85 mm in length supports a overhanging shaft, running at 1000 r.p.m. the room temperature is 30°C, and the bearing temperature is 75°C. The viscosity of the oil used is 0.012 kg/m-s at the operating temperature of 320°C. The diametral clearance is 0.08 mm, and the bearing is to operate in still air, without any artificial cooling. Determine i) the permissible load on the bearing, and ii) power loss
b) Explain design of ball bearings. [5+5]

OR

- 14 What procedure would you follow while designing a ball and roller bearing? Explain. [10]

- 15 a) Design the connecting rod for a petrol engine, from the following data: Diameter of the piston = 210 mm Mass of the reciprocating parts = 3 kg Length of the connecting rod = 325 mm Stroke length = 250 mm Speed = 2500 r.p.m, with permissible over speed of 5500 r.p.m Compression ratio = 4, Maximum explosion pressure = 3.5 N/mm².
b) At what angle, the twisting moment is maximum in the crank shaft? Explain. [5+5]

OR

- 16 a) Design a cast iron piston for a four stroke I.C engine, for the following specifications: Cylinder bore = 120 mm Stroke length = 250 mm Maximum gas pressure = 6 MPa Brake mean effective pressure = 0.8 MPa Fuel consumption = 0.35 kg/kW/hr Speed = 2400 r.p.m Assume any other data necessary for the design.
b) What are the cross-sections commonly employed for connecting rods? Why is I-section chosen for high-speed I.C engines? [5+5]

- 17 a) Explain co-axial springs?
b) Find the maximum shear stress and deflection induced in a helical spring of the following specifications, if it has to absorb 2000 N-m of energy. Mean diameter of spring = 200 mm; Diameter of steel wire, used for making the spring = 30 mm; Number of coils = 40; Modulus of rigidity of steel = 95 kN/mm². [5+5]

OR

- 18 a) In a crossed belt drive the diameters of the driver and follower pulleys are 300 mm and 500 mm respectively. The centre distance of the drive is 3 m. The driver pulley rotates at 500 r.p.m. Find the angle of contact between belt and both the pulleys, and the length of the belt required. What is the power capacity of the drive, if the permissible tension in the belt is 4.2 kN, and the coefficient of friction between the belt and both the pulleys is 0.35?
b) Describe the basic procedure for selection of V – belts for power transmission. [5+5]

- 19 Explain why helical gears are capable of transmitting greater power than spur gear? [10]

OR

- 20 a) It is required to design a pair of spur gears with 200 full depth involute teeth consisting of a 20-teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to 32.5 KW, 1450 rpm electric motor. The starting torque of the motor can be taken as 250% of the rated torque. the material for pinion is plain carbon steel Fe 520 (Sut = 410 N/mm²), while the gear is made of grey cast iron FG 300 (Sut = 200 N/mm²). The factor safety is 1.6. Design the gears based on the lewis equation and using velocity factor to account for the dynamic load.

- b) Design a pair of spur gears with stub teeth, and to transmit 60 KW. From 180 mm pinion, running at 2100 r.p.m to a gear running at 1500 r.p.m. Both the gears are made of steel having BHN of 280. Determine the pitch of the gears by means of Lewis equation, and then modify the dimensions if required, to keep within the limits set by the dynamic and wear load requirements. [5+5]