

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VII EXAMINATION – WINTER 2025****Subject Code:2171909****Date:20-11-2025****Subject Name:Machine Design****Time:10:30 AM TO 01:30 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Use of Design data book is allowed.

		Marks
Q.1	(a) Why pressure angle is generally taken as 20° ? What is its effect?	03
	(b) What is Lewis form factor? How does it vary with number of teeth on gear?	04
	(c) Explain different types of gear tooth failures, causes and their possible remedies.	07
Q.2	(a) Explain the rules for selection of best structural diagrams.	03
	(b) Explain the range ratio in gear box design.	04
	(c) It is required to design a pair of spur gears with 20° full-depth involute teeth based on the Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 kW, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4: 1. The pinion as well as the gear is made of plain carbon steel 40C8 (Sut = 600 N/mm ²). The factor of safety can be taken as 1.5. Design the gears, specify their dimensions and suggest suitable surface hardness for the gears.	07
OR		
	(c) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° , while the helix angle is 25° . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 (Sut = 600 N/mm ²) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears.	07
Q.3	(a) Explain the significance of L/D ratio and minimum oil-film thickness in hydrodynamic bearings.	03
	(b) Explain the design parameters to be considered in the performance of a hydrodynamic bearing.	04
	(c) The following data is given for a 360° hydrodynamic bearing: radial load = 10 kN journal speed = 1440 rpm unit bearing pressure = 1000 kPa clearance ratio (r/c) = 800 viscosity of lubricant = 30 mPa s Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate: (i) dimensions of bearing; (ii) coefficient of friction; (iii) power lost in friction; (iv) total flow of oil; (v) side leakage; and (vi) Temperature rise.	07

OR

- Q.3** (a) Differentiate rolling contact bearings over sliding contact bearings. **03**
(b) Derive the equation for equivalent dynamic load for bearing under cyclic loads. **04**
(c) A single-row deep groove ball bearing No. 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. **07**
- Q.4** (a) Explain the criteria of design of push rod in IC engines. **03**
(b) Discuss the different types of piston rings and function of each one of it. **04**
(c) Explain different types of crankshafts used in IC Engine with their application. **07**

OR

- Q.4** (a) With neat sketch explain the 'inertia bending forces' acting on connecting rod of an Internal Combustion (IC) engine. **03**
(b) Describe the design procedure of a crank shaft of an Internal Combustion (IC) engine. **04**
(c) What are the functions of rib, cup, compression ring and oil scraper ring in piston? **07**
- Q.5** (a) Explain different types of loads handled by material handling equipments. **03**
(b) Explain the complete designation of steel wire ropes. **04**
(c) Explain the need of material handling equipments. Also, Classify material handling equipments. **07**

OR

- Q.5** (a) Explain the stresses developed in wire ropes. **03**
(b) Explain the design methodology of hoisting drum. **04**
(c) Explain the design methodology of a rocker arm. **07**
