Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII (New) EXAMINATION – WINTER 2019

Subject Code: 2171909 **Date: 30/11/2019**

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. **Design data book is permitted.**

Q.1	**(a)**	Discuss different types of failure in gear design.	**03**
	(b)	Draw the Free Body Diagram of a spur gear pair and derive the relations for various forces acting on gear tooth pair.	**04**
	(c)	Explain the design procedure of helical gear based on beam strength and wear strength theory.	**07**
Q.2	**(a)**	Explain different types of worm gears with their application.	**03**
	(b)	Explain importance of material selection in worm and worm wheel design.	**04**
	(c)	A pair of bevel gears consists of a 30 tooth pinion meshing with a 48 tooth gear. The axes of the connecting shafts are right angles to each other. Assume the module of the gears to be 5 at the larger end. Calculate: 1. The pitch circle diameters of pinion and gear. 2. The pitch angles of pinion and gear. 3. The cone distance. 4. The mean radii of the pinion and gear. 5. Back cone radii of the pinion and gear.	**07**
		OR	
	(c)	Draw the structure and speed diagram for a gearbox having operating speed range from 31.5 rpm to 560 rpm. Use R4 series, with standard spindle speeds, the gearbox is connected to a motor driven by a pair of pulleys. Assume the motor speeds to be 1440 rpm. Draw the gearbox layout diagram.	**07**
Q.3	**(a)**	Explain hydrostatic and hydrodynamic lubrication in journal bearing with its application in engineering.	**03**
	(b)	Derive and explain the importance of bearing characteristic number in design of journal bearing.	**04**
	(c)	A 360° hydrodynamic bearing operates under the following conditions: radial load = 50 kN journal diameter = 150 mm bearing length = 150 mm radial clearance = 0.15 mm minimum film thickness = 0.03 mm viscosity of lubricant = 8 cP What is the minimum speed of operation for the journal to work under hydrodynamic conditions?	**07**
		OR	
Q.3	**(a)**	Explain the importance of preloading in rolling contact bearing.	**03**
	(b)	Explain the design of ball bearing subjected to cyclic load and speeds.	**04**
	(c)	Find the rating life of the 50 mm bore, light series, ball bearing under 6800 N radial load at 600 rpm. The load is out of balance and rotates with inner ring. Assume there is no shock loading.	**07**
Q.4	**(a)**	Enlist ten different principles of material handling used in industrial handling.	**03**
	(b)	Explain Bridge Crane types, characteristics and applications in engineering.	**04**
	(c)	Explain Design procedure of wire ropes.	**07**

OR

Q.4	**(a)**	Enlist main elements used in hoisting equipments.	**03**
	(b)	Explain the Design of hoisting drum.	**04**
	(c)	Design the crane hook of a hoisting block for a maximum load lifting capacity of 10 ton. The material for hook is forged for which permissible tensile stress may be taken as 120 N/mm^2. Use the modified triangular section for hook..	**07**
Q.5	**(a)**	Explain the effect of number of cylinders on the performance of an IC Engine.	**03**
	(b)	Explain the importance of surface treatment of cylinder liners.	**04**
	(c)	The following data is given for the piston of a four-stroke diesel engine: Cylinder bore = 250 mm Maximum gas pressure = 4 MPa Bearing pressure at small end of connecting rod = 15 MPa Length of piston pin in bush of small end = 0.45D Ratio of inner to outer diameter of piston pin = 0.6 Mean diameter of piston boss = 1.4 x outer diameter of piston pin Allowable bending stress for piston pin = 84 N/mm^2 Calculate: (i) outer diameter of the piston pin; (ii) inner diameter of the piston pin; (iii) mean diameter of the piston boss; and (iv) Check the design for bending stresses.	**07**

OR

Q.5	**(a)**	Explain the most usual causes of failure of the crank shafts.	**03**
	(b)	Explain valve gear mechanism in IC Engine.	**04**
	(c)	Determine the dimensions of cross-section of the connecting rod for a diesel engine with the following data: Cylinder bore = 100 mm Length of connecting rod = 350 mm Maximum gas pressure = 4 MPa Factor of safety = 6	**07**

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