

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (OLD) EXAMINATION – WINTER 2023****Subject Code:2170202****Date:16-12-2023****Subject Name: Automobile Component 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.

		MARKS
Q.1	(a) Explain the concept of standardization?	03
	(b) List out the main types of bearing materials and their properties used in sliding contact bearings?	04
	(c) It is required to standardize eleven shafts from 100 to 1000 mm diameter. Specify their diameters.	07
Q.2	(a) What are the basic considerations in design of multi speed gearbox?	03
	(b) Define Creep. Explain its important on the design of any machine components.	04
	(c) Explain the design for manufacturing (DFM) and design for assembly (DFA).	07
	OR	
	(c) List out the general principles to be followed for the design of machined parts?	07
Q.3	(a) State the law of gearing.	03
	(b) Give a different mode of failure of gear teeth and their possible remedies.	04
	(c) Derive Stribeck's equation used in rolling contact bearing design.	07
	OR	
Q.3	(a) Define following terms in connection with gear tooth: 1. Backlash 2. Path of contact 3. Module	03
	(b) Based on the thickness of layer of the lubricant between the bearing and the journal, classify sliding contact bearings.	04
	(c) A pair of cast iron bevel gears connect two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth profiles of the gears are of 14 1/2° composite form. The allowable static stress for both the gears is 55 MPa. If the pinion transmits 2.75 kW at 1100 r.p.m., find the module and number of teeth on each gear from the standpoint of strength and check the design from the standpoint of wear. Take surface endurance limit as 630 MPa and modulus of elasticity for cast iron as 84 kN/mm ² .	07
Q.4	(a) Why I section is more preferred for connecting rod?	03
	(b) State the limitations of using worm gears?	04
	(c) A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm ² . The speed of the journal is 900 rpm and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. Find:	07

1. The amount of artificial cooling required, and
2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C . Take specific heat of the oil as $1850 \text{ J/kg}^{\circ}\text{C}$.

OR

Q.4 (a) Explain the working of valve gear mechanism for a given I.C. Engine with neat sketch. **03**

(b) Give the detailed classification of the gearboxes. **04**

(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 ($S_{ut} = 600 \text{ N/mm}^2$) 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. Take Values of the Lewis form factor Y for 20° full-depth involute system as 0.3475. **07**

Q.5 (a) State the function of following for an I C Engine piston:
1. Piston rings 2. Piston skirts 3. Piston pin. **03**

(b) What is meant by 'crush' and 'shim' related to big end of connecting rod? **04**

(c) Design a cast iron piston for a single acting four stroke engine for the following data: **07**

Cylinder bore = 100 mm; Stroke = 125 mm; Maximum gas pressure = 5 N/mm^2 ; Indicated mean effective pressure = 0.75 N/mm^2 ; Mechanical efficiency = 80%; Fuel consumption = 0.15 kg per brake power per hour; Higher calorific value of fuel = $42 \times 10^3 \text{ kJ/kg}$; Speed = 2000 rpm.

Any other data required for the design may be assumed.

OR

Q.5 (a) Give a difference between wet liner and dry liner in IC Engines. **03**

(b) It is preferred to provide a greater number of thin piston rings than small number of thick rings' Justify the statement. **04**

(c) A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500 mm. The speed of the electric motor is 900 rpm and the speed of the compressor shaft is desired to be 200 rpm. The torque, to be transmitted is 5000 N-m. Taking starting torque as 25% more than the normal torque, determine:

1. Module and face width of the gears using 20 degrees stub teeth, and
2. Number of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor.
