Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2017

Subject Code: 2170202 Date: 10/11/2017

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.**

MARKS

Q.1 **(a)** Why thin sections should be avoided in forged components? **03**

(b) What is creep? Explain the situations where creep is a serious problem. **04**

(c) A manufacturer is intended to start production of electric motors with five different models ranging from 10kW to 100kW capacities. Specify the capacities of models. If the manufacturer wants to expand the production by introducing models from five to nine, specify the power capacities of the additional models. **07**

Q.2 **(a)** What are the advantages of hydrostatic bearings? **03**

(b) What are the principal types of wear undergone by rolling contact bearings? Mention its causes and remedies. **04**

(c) A single row deep grove ball bearing is used to support the lay shaft of a four speed automobile gearbox.It is subjected to the following loads in respective speed ratios: **07**

Gear	*Axial load(N)*	*Radial load(N)*	*% time engaged*
First gear	3250	4000	1%
Second gear	500	2750	3%
Third gear	50	2750	21%
Fourthgear	Nil	Nil	75%

The lay shaft is fixed to engine shaft and rotates at 1750 rpm. The static and dynamic load carrying capacities of bearings are 11600 N and 17600N respectively. Calculate the bearing life in millions of revolutions. Refer Table 1 for axial and radial factors.

Table 1

$[F_a/C_0]$	$[F_a/F_r] \le e$		$[F_a/F_r] \ge e$		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

OR

(c) The following data is given for a pair of spur gears with 20º full depth involute teeth: **07**
Number of teeth on pinion=24, Number of teeth on gear=56 , Speed of pinion=1200 rpm., Module=3mm, Service factor=1.5,Face width=30mm, Factor of safety=1.5
Lewis form factor for pinion=0.337

Both gears are made of same material with an ultimate tensile strength of 600N/mm^2.Using velocity factor to account for dynamic load, calculate (i)beam strength,(ii) velocity factor and(iii) rated power that the gears can transmit without bending failure

Q.3 **(a)** What is meant by scoring of gear tooth? Mention its causes and remedies **03**

(b) What are the conditions where non metallic gears are used? **04**

(c) The following data is given for a pair of parallel helical gears made of steel: per transmitted=20kW, speed of pinion=720 rpm, number of teeth on pinion=35, number of teeth on gear =70, centre distance=285mm, normal module=5mm, face width=50mm, normal pressure angle=20^o, ultimate tensile strength=600N/mm^2, surface hardness=300BHN, service factor=1.25.Take Y=0.399 for formative number of teeth. Calculate (i) the helix angle, (ii)the beam strength,(iii) the wear strength **07**

OR

Q.3 **(a)** What is meant by corrosive wear of gear tooth? Mention its causes and remedies. **03**

(b) Derive the expression for beam strength of a spur gear tooth. **04**

(c) A pair of spur gears with 20^o pressure angle consists of 25 teeth pinion meshing with a 60 teeth gear. The module is 5mm, while face width is 45 mm. The pinion rotates at 500rpm.The gears are made of steel and heat treated to surface hardness of 220BHN. Assume that dynamic load is accounted by means of the velocity factor.The service factor and factor of safety are 1.75 and 2 respectively. Calculate (i) Wear strength of gears,(ii) the static load that the gears can transmit without pitting and (iii) rated power that can be transmitted by gears. **07**

Q.4 **(a)** What the characteristics expected from the materials used for making valves in IC engines? **03**

(b) Justify the given statement "It is preferred to provide more number of thin piston rings than a small number of thick rings" **04**

(c) The bore of a cylinder of the four-stroke diesel engine is 120mm. the maximum gas pressure inside the cylinder is limited to 4 MPa. The cylinder head is made of cast iron and allowable tensile stress is 40N/mm^2. Determine the thickness of cylinder head the studs, which are made of steel, have allowable stress as 50N/mm^2 determine
1) number of studs 2) nominal diameter of studs, 3) pitch of studs. **07**

OR

Q.4 **(a)** A pair of straight bevel gears consists of 24 teeth pinion meshing with 40 teeth gear.The module at the large end of the teeth is 5mm,whle the face width is 40mm.If the axes of the connecting shafts are at right angles to each other, calculate,
i) the pitch cone distance, ii)pitch cone angles of pinion and gear, iii)mean radii of pinion and gear. **03**

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

(c) The following data is given for the piston of four stroke diesel engine **07**

Cylinder bore = 250mm, 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 of piston pin = 0.6, mean diameter of piston boss = 1.4 x outer diameter of piston pin, allowable bending stress for piston pin = 84N/mm^2. Calculate.

1-Outer diameter of piston pin.

2-Inner diameter of piston pin.

3-Mean diameter of the piston boss and

4-Check the design for bending stresses.

Q.5 **(a)** What are the reasons to provide with a number of ribs in piston head? **03**

(b) A worm gear pair is used to transmit power from an electric motor running at 1500 **04**

rpm to the machine running at 60 rpm. The axial pitch of the worm s 18.85mm while the diametral quotient is 10. If the centre distance is to be fixed at 180mm, designate the gear pair.

(c) What is the difference between center and overhung crank shafts? Where do you use both? What are the main advantages of overhung crank shafts? Also draw neat sketch diagram for both. **07**

OR

Q.5 **(a)** What are the advantages of using worm gears? **03**

(b) What are the parameters required in kinematic design of multi speed gearbox? **04**

(c) Determine the dimensions of cross section of connecting rod for a diesel engine with data cylinder bore = 100mm, length of connecting rod = 320mm, maximum gas pressure = 2.45Mpa, factor of safety against buckling failure = 5 , material of connecting rod is steel, constant 'a' for steel material is $\frac{1}{7500}$, K_{xx}=1.78t, σ_c=330N/mm^2 also determine variation of height. Assume necessary data if required. **07**