GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3170202   **Date:24-11-2025**

Subject Name:Automotive Component and system 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 unilateral and bilateral tolerances.	**03**
	(b)	It is required to standardize eleven shafts from 100 to 1000 mm diameter. Specify their diameters.	**04**
	(c)	Derive Stribeck's equation. Also state the assumptions made for it.	**07**
Q.2	**(a)**	Define the following terms: (1) Pitch circle diameter (2) Circular pitch (3) Backlash	**03**
	(b)	What is formative number of teeth in helical gear? Derive the expression for formative number of teeth in helical gears.	**04**
	(c)	A taper roller bearing has a dynamic load capacity of 26 kN. The desired life for 90 % of the bearings is 8000 h and the speed is 300 rpm. Calculate the equivalent radial load that the bearing can carry.	**07**

OR

	(c)	A pair of spur gears with 20° full-depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 N/mm^2. The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety are 1.5. Determine the rated power that the gears can transmit. Take Lewis form factor is 0.32 for 20 teeth.	**07**
Q.3	**(a)**	State the function of following for an IC Engine piston: 1. Piston rings 2. Piston skirts 3. Piston pin.	**03**
	(b)	Define the following terms as applied to rolling contact bearings: (1) Basic static load rating (2) Static equivalent load (3) Basic dynamic load rating (4) Dynamic equivalent load.	**04**
	(c)	Derive the condition for constant velocity ratio of gearing.	**07**

OR

Q.3	**(a)**	Define the following terms with respect to Bevel gears: (1) Root angle (2) Crown height (3) Back cone distance.	**03**
	(b)	Give a different mode of failure of gear teeth and their possible remedies.	**04**
	(c)	Give a comparison of wet liner and dry liner in IC Engines.	**07**
Q.4	**(a)**	Why do inlet and exhaust valves have conical heads and seats?	**03**
	(b)	What is the function of leaf spring? List the materials commonly used for the manufacture of the leaf springs	**04**
	(c)	A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 rpm. If the gear has 24 teeth, determine the necessary module, pitch	**07**

diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as
[0.154 – (0.912/T_E)] where, T_E represents the equivalent number of teeth.

OR

Q.4	(a)	Why I section is more preferred for connecting rod?	03
	(b)	What is the function of a valve gear mechanism? Explain with neat sketches the valve gear mechanism in case of a vertical and horizontal engine.	04
	(c)	Design a leaf spring for the following specifications: Total load = 140 kN; Number of springs supporting the load = 4; Maximum number of leaves = 10; Span of the spring = 1000 mm; Permissible deflection = 80 mm. Take Young's modulus, E =200kN/mm² and allowable stress in spring material as 600 MPa.	07

Q.5	(a)	Explain brake efficiency.	03
	(b)	Explain the ray and structural diagram with suitable example.	04
	(c)	Design a gear box for a head stock to give 16 speeds ranging from 50 rpm to 1600 rpm. The power is supplied by an electric motor of 10 kw, running at 1440 rpm, through a V-belt drive with a speed reduction of 2:1. Find the no. of teeth on each gears.	07

OR

Q.5	(a)	Give a difference between a tire and a wheel?	03
	(b)	With neat sketch explain hydraulic braking system.	04
	(c)	Describes worm and sector type steering gear box.	07

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