Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2025

Subject Code:3170202 Date:19-05-2025

Subject Name:Automotive Component and system Design

Time:02:30 PM TO 05:30 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)**	Define brake fade.	**03**
	(b)	Explain the design for manufacturing and design for assembly.	**04**
	(c)	Derive Stribeck's equation.	**07**
Q.2	**(a)**	Explain preloading of rolling contact bearing.	**03**
	(b)	Define Dynamic Load Carrying Capacity.	**04**
	(c)	A single-row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 1200 rpm. The expected life L10h of the bearing is 20 000 h. The minimum acceptable diameter of the shaft is 75 mm. Select a suitable ball bearing for this application.	**07**
		OR	
	(c)	A single-row deep groove ball bearing is subjected to a pure radial force of 3 kN from a shaft that rotates at 600 rpm. The expected life L10h of the bearing is 30 000 h. The minimum acceptable diameter of the shaft is 40 mm. Select a suitable ball bearing for this application.	**07**
Q.3	**(a)**	State different modes of gear teeth failures.	**03**
	(b)	Define following terms (1) Pitch circle (2) Pressure angle (3) Module (4) Addendum.	**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 (S = 600 N/mm2). 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	
Q.3	**(a)**	Write advantages and disadvantages of worm gears.	**03**
	(b)	Justify the use of involute profile for gear tooth.	**04**
	(c)	A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 40 teeth gear. The helix angle is 25° and the normal pressure angle is 20°. The normal module is 3 mm. Calculate (i) the transverse module; (ii) the transverse pressure angle; (iii) the axial pitch; (iv) the pitch circle diameters of the pinion and the gear; (v) the centre distance; and	**07**

(vi) the addendum and dedendum circle diameters of the pinion.

Q.4 **(a)** Explain the Ackermann steering principle. **03**

(b) Compare Disc Brake with Drum Brake. **04**

(c) Following data is given for a caliper disk brake with annular pad, for the front wheel of the motorcycle: **07**
torque capacity = 1500 N-m
outer radius of pad = 150 mm
inner radius of pad = 100 mm
coeffi cient of friction = 0.35
average pressure on pad = 2 MPa
number of pads = 2
Calculate the angular dimension of the pad.

OR

Q.4 **(a)** Define brake efficiency. **03**

(b) Explain the functions of piston rings. **04**

(c) The following data is given for a caliper disk brake, with circular pad, for the lightweight two-wheeler, **07**
torque capacity = 1500 N-m
number of caliper brakes on the wheel = 3
number of pads on each caliper brake = 2
coeffi cient of friction = 0.35
average pressure on pad = 2 MPa The ratio of pad radius to the distance of the pad center from axis of disk is 0.2. Calculate the radius of the pad.

Q.5 **(a)** Calculate the minimum stopping distance for a vehicle travelling at 60 km/hr with a deceleration equal to the acceleration due to gravity. **03**

(b) Explain tractive effort. **04**

(c) The following data is given for the piston of a four-stroke diesel engine: **07**
Cylinder bore = 250 mm
Maximum gas pressure = 4 MPa
Allowable bearing pressure for skirt = 0.4 MPa
Ratio of side thrust on liner to maximum gas load on piston = 0.1
Width of top land = 45 mm
Width of ring grooves = 6 mm
Total number of piston rings = 4
Axial thickness of piston rings = 7 mm
Calculate:
(i) length of the skirt; and
(ii) length of the piston.

OR

Q.5 **(a)** Define the advantages and disadvantages of wet liner and Dry liner in IC Engines. **03**

(b) Explain the desirable properties of cylinder materials. **04**

(c) Determine the dimensions of cross-section of the connecting rod for a diesel engine with the following data: **07**
Cylinder bore = 100 mm
Length of connecting rod = 350 mm
Maximum gas pressure = 4 MPa
Factor of safety = 6

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