C.U.SHAH UNIVERSITY Winter Examination-2018

Subject Name: Automobile Component Design Subject Code: 4TE06ACD1 Semester: 6 Date: 24/10/2018

Branch: B.Tech (Automobile) Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

0-1		Attempt the following questions:	(14)
C	a)	What conditions must be satisfied for a pair of gears to have a constant velocity ratio?	01
	b)	Why pinion is weaker than the gear made of same material?	01
	c)	What are the forces acting on rocker arm?	01
	d)	Define multi-throw crankshaft.	01
	e)	What is L ₅₀ life?	01
	f)	Define adequate design?	01
	g)	Which curves satisfy fundamental law of gearing?	01
	h)	Define the term "piston seizure".	01
	i)	Why hollow piston pin is preferred over solid one?	01
	j)	At what angle of crank, is the crankshaft subjected to maximum torque in petrol Engine?	01
	k)	Define Semi-floating type wrist pin?	01
	I)	What is the interference angle between the valve seat and valve-seating surface?	01
	m)	Specify machine tools for making gears.	01
	n)	What is the optimum value of face width in terms of module?	01
Attemp	ot any f	our questions from Q-2 to Q-8	

Q-2 **Attempt all questions** (14)a) Write the name of methods reducing thermal expansion of piston skirt. 02 **b**) Design a suitable gear box that has a speed variation of 125 rpm to 1500 rpm in 10 12 steps. The power is supplied to the input shaft by an electric motor of 5 kw running at 1500 rpm, through a belt drive giving a speed reducing of 12:1. Draw the structural diagram, speed, speed chart, and the number of teeth on gears. Draw the schematic diagram. If the allowable shear stress for the shaft material is 45 MPa, find the sizes of the shafts. **Q-3** Attempt all questions (14)

A shaft is supported at a distance of 120 mm towards left and at a distance of 200 07 **a**) mm towards right side of loading point at which a radial load of 1600 N and a tangential load of 3000 N are acting. Calculate the basic dynamic capacity of a



highly loaded bearing for an operating life of 5 years during which the bearing operates for 30 % of the time at 1800 rpm.

Explain the step by step design procedure for piston in IC Engine. b)

Q-4

07

(14) **06**

(14)

04

(14)

(14)

(14)

03

Explain Wedge film lubrication in detail with neat sketch. a) A pair of helical gears consisting of 30 teeth on pinion and 120 teeth on gears, is 08 b) used to transmit power from the pinion rotating at 750 rpm. The normal module is 5 mm and face width is 60 mm. The gears are made of carbon steel having a ultimate stress of 600 MPa, and heat treated to a surface hardness of 250 BHN. Assuming a service factor of 1.5 and wear factor $K = 0.156 [BHN/100]^2$, find the power transmitting capacity of gears. Assume the helix angle of 30° . Take K_v = 4.5/ (4.5+V) and FOS of 3.

Q-5 Attempt all questions

Attempt all questions

- A Pair of bevel gears are used for 90° shaft, to transmit 12.5 kw at 1500 rpm. The 10 a) module is 5 mm. the pinion and gear; both are made of steel, having allowable static stress of 210 MPa and have surface hardness of 240 BHN. It has surface endurance limit of 620 MPa. The pinion has 30 teeth and the gear has 90 teeth, with 20° full depth involute profile. The gears are cut carefully. The gear drive is used for 8 hours per day with a steady load condition. Assuming face width as 03 times the pitch cone distance, determine,
 - (i) Magnitude of induced bending stress.
 - (ii) Magnitude of dynamic tooth load.
 - (iii) Magnitude of wear load
- State the limitation of Lewis equation for gear design? **b**)

Q-6 Attempt all questions

- Determine the thickness of cylinder, cylinder head, number of bolts, size of bolt 07 a) and pitch of bolt for a 4-stroke diesel engine cylinder of 250 mm bore and allowable stress of 42 MPa. Take maximum explosion pressure of 3 N/mm². Take $\sigma_t = 65$ MPa for Ni-steel bolts. Also find outer diameter of cylinder flange.
- Explain the different causes of gear tooth failures and suggest possible remedies 07 b) to avoid such failures.

Q-7 Attempt all questions

- a) Explain important factors to be considered in the selection of bearing material in 04 detail? 04
- Write a short note on Thermal Considerations in worm gear? b)
- Sketch a valve gear mechanism of an internal combustion engine and label its 06 **c**) various parts.

Q-8 Attempt all questions

- Sketch and explain the various stresses induced in the crankshaft. 07 a) Explain with neat sketch generation of Involute and Cycloidal tooth profile? 04 b)
- Why worm gear always governs the design in worm gear pair? c)

