C.U.SHAH UNIVERSITY **Summer Examination-2017**

Subject Name: Automobile Component Design

	Subject	Code: 4TE06ACD1	Branch: B.Tech (Automol	oile)	
	Semeste Instructio		Time: 02:30 To 05:30	Marks: 70	
	(2) 1 (3) 1	Instructions written on main answ Draw neat diagrams and figures (i		-	
Q-1		Attempt the following question	ns:		(14)
	a)	Cycloidal tooth gears are used it (a) automobile gearbox (b) mac clocks (d) materials handling eq	hine tool gearbox (c) spring driver	watches and	(1)
	b)	A rack is a gear with,	nfinite module (c) infinite circular	pitch (d) none	(1)
	c)	If μ = absolute viscosity, N= spectrum the bearing characteristic n (a) μ N/p (b) μ p/N (c) pN/ μ (d)		ring pressure,	(1)
	d)	journal is called	erial to yield and adopt its shape to bility (c) viscosity (d) endurance li		(1)
	e)	•	pared to sliding contact bearings h le axial space (c) generate less noi		(1)
	f)	The main function of an automo	bbile gearbox is se speed (c) to provide variable sp	eeds	(1)
	g)	· · · · ·		-	(1)
	h)	The spokes of the flywheel are s (a) direct shear (b) torsional she	5		(1)
	i)		louble start worm meshing with a start	50 teeth	(1)
	j)	The rolling contact bearing is ki		bush bearing	(1)
	k)		g rod to the crank radius (L/r) is us Page 1 3	-	(1)



a) 1.5 to 2 (b) 10 to 12 (c) 4 to 5 (d) 1:1

- The listed life of a rolling bearing, in a catalogue, is the

 (a) minimum expected life (b) maximum expected life (c) average life (d) none
 Cylinder thickness is calculated on the basis of.....stress
 (1)
- m) Cylinder thickness is calculated on the basis of.....stress
 (a) radial (b) residual stress (c) whipping stress (d) circumferential hoop stress
- n) The minimum number of teeth on pinion to avoid interference in rack and pinion (1) is (a) 15 (b) 18 (c) 21 (d) 24

Attempt any four questions from Q-2 to Q-8

Q-2 Attempt all questions

- a) Discuss the various causes of gear tooth failure and write the possible remedies to (04) overcome gear tooth failure.
- b) A pair of helical gears are to transmit 15 kW, The teeth are 20° stub in diametral (10) plane and have a helix angle of 45° . The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa, determine a suitable module and face width from static strength consideration and check the gears for wear. ($\sigma_{es} = 618$ MPa, tooth form factor for 20° stub sytem $y_p = 0.175 \cdot 0.841/T_E$, $C_v = 0.75/0.75 + v$, $E_P = E_G = 200*10^3$ N/mm²)

Q-3 Attempt all questions

- a) Define formative number of teeth of bevel gear and also sketch the tooth (07) terminology of bevel gears with neat labelled.
- b) A pair of bevel gears connect at right angles and transmits 9 kW. Determine the required module and gear diameter for the following specifications: (07)

Particulars	Pinion	Gear
No. of teeth	21	60
Material	Semi-steel	Grey C I.
BHN	200	160
Speed	1200 rpm	420 rpm
Tooth profile	$14-1/2^0$ composite	$14-1/2^0$ composite
σο	85 MPa	55 MPa

Check the gears for dynamic as well as for wear load.

(Take, $y_P = y_G = 0.124-0.684/T_E$, $C_v = 6/6+v$, error action, e = 0.055 mm, K =0.107, $E_P = 210*10^3$ N/mm², $E_G = 84*10^3$ N/mm²)

Q-4

A three stage gear box with twelve speeds is to be designed based on R 10 series (14) with minimum spindle speed of 125 rpm. The second stage consists of three speed steps. The electric motor is connected to the gear box through a belt drive and runs at 1500 rpm and transmits of 5 kW. The reduction through belt drive between motor and input shaft = 1:2. Determine:

Standard speed 2. Draw structure and speed diagram for the arrangement
 Determine no. of teeth in each gear

(For R 10 series standard speed as: 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000, 1250 & 1500 rpm)

Q-5 Attempt all questions

a) Explain the principle of hydrodynamic journal bearing.

(07)





b) Design a full hydrodynamic journal bearing with the following specifications for (07) machine tool applications:

machine toor applications.		_		
Journal diameter	75 mm			
Radial Load	10 kN			
Journal Speed	1440 rpm			
Minimum oil film thickness	22.5 microns			
Inlet Temperature	$40^{\circ}\mathrm{C}$			
Bearing Material	Babbit			
Determine the length of bearing and se	lect a suitable oil film for this	1		
applications.				
(Take, Bearing pressure = 2 N/mm^2 , S =	= 0.264, CFV = 5.79, FV = 3.99)			
Attempt all questions				
Derive the expression for stribeck's equation for rolling contact bearing. Write				
the limitations of equation.				
Explain bearing life, dynamic & equivalent load carrying capacity of rolling				
contact bearing.				
Attempt all questions				
Explain thermal consideration while des	signing worm and worm wheel drive.	(
Design a cast iron piston for a single act	ting four stroke diesel engine with the	(
following data:				
Cylinder bore	300 mm			
Length of stroke	450 mm			
Speed	300 rpm			
Indicated mean effective pressure	0.85 MPa			
Maximum gas pressure	5 MPa			
Fuel consumption	0.30 kg/BP/hr			
H.C.V. of fuel	44,000 kJ/kg			
Assume suitable data if required.		i.		

Assume suitable data if required.

(Take, for CI piston , $\sigma_t = 40 \text{ N/mm}^2$, $\eta_m = 80 \%$, C = 0.05, k = 46.6 W/m /⁰C, $T_c-T_e = 220 \ ^0$ C)

(For CI piston rings, $\sigma_t = 90 \text{ N/mm}^2$, $p_w = 0.035 \text{ MPa}$), (for piston skirt, $p_b = 0.45 \text{ Pa}$, $\mu = 0.1$, for piston), (for piston pin, $p_{b1} = 30 \text{ MPa}$, $\sigma_t = 140 \text{ N/mm}^2$)

Q-8 Attempt all questions

Q-6

O-7

a)

b)

a) b)

a) What are the desirable properties of cylinder materials and write the advantages (04) of aluminium alloy piston over cast iron piston.

(10)

b) The cylinder of 4-stroke diesel engine has the following specifications: Brake power = 7.5 kW, Speed = 1400 rpm, Indicate mean effective pressure = 0.35 MPa, Mechanical efficiency = 80 %, Maximum gas pressure = 3.5 MPa. The cylinder liner and head are made of grey cast iron FG 260 (σ_{ut} = 260N/mm² & μ = 0.25), The studs are made of plain carbon steel 40 C 8 (S_{yt} = 380 N/mm²), F. S. for all parts =6. Calculate:

(i) bore and length of cylinder liner (ii) thickness of the cylinder liner

(iii) thickness of the cylinder head (iv) size, number and pitch of studs.

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