GUJARAT TECHNOLOGICAL UNIVERSITY
B E Sem-VI Examination May 2011

Subject code: 160201
Subject Name: Automobile Component Design

Date:16/05/2011   **Time: 10.30 am – 01.00 pm**
Total Marks: 70

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Illustrate your answer with neat sketches wherever required.**

Q.1 **(a)** Define gear drive. Write the advantages and disadvantages of gear drive compared to other power transmission devices. **04**

(b) Design a spur gear pair from the following given data. **10**
Power to be transmitted = 22.5 kW
Pinion speed = 1450 rpm, Speed reduction = 2.5
No. of teeth on pinion = 20, Service factor = 1.5

$Ratio, \dfrac{Face\,width}{Module} = 10$

Pitch line velocity = 5 m/sec (For initial calculation of module)
Maximum permissible error in gear tooth profile = 0.025 mm

$Velocity\,factor, C_V = \dfrac{3}{3+v}$

$Lewis\,form\,factor, y = \left(0.154 - \dfrac{0.912}{Z}\right) for\ 20^0\ pressure\,angle\,involute\,tooth\,system$

The materials and stresses are as under:

Material	$[\sigma_b]$	Elasticity Modulus	Hardness
Pinion (Fe 410)	135 N/mm^2	2.1 x 10^5 N/mm^2	260 BHN
Gear (FG 200)	65 N/mm^2	1.1 x 10^5 N/mm^2	250 BHN

$Dynamic\,load\,equation, F_d = F_t + \dfrac{21.v\left(f.C + F_t\right)}{21.v + \sqrt{f.C + F_t}}$

$Wear\,load, F_W = d_P.f.KW.Q$

Q.2 **(a)** SKF 6306 ball bearing with inner ring rotation has 10 seconds work cycle as follows: **07**

	For 2 sec.	For 8 sec.
Radial load	3640 N	2730 N
Axial load	1820 N	0
RPM	900	1200
Type of load	Light shock	Steady load

For SKF bearing static capacity, C$_o$ = 14600 N and dynamic capacity, C = 22000N.
Find the expected average life of the bearing. **[P.T.O.**

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(b) Explain the following terms in relation with rolling contact bearings: **07**
    (i) Static load capacity
    (ii) Dynamic load capacity
    (iii) Equivalent load
    (iv) Bearing life

OR

(b) Explain the important steps of multi speed automobile gear box design.   **07**

Q.3 (a) Why are helical gears preferred over spur gears at higher speeds?   **04**
(b) Design a pair of helical gears to transmit 50 kW at a speed of 1440 rpm to a shaft **10** required to run at 480rpm. The helix angle is approximately 25^0 and 20^0 full depth teeth are used. Both the gear and pinion are made of steel with permissible stress 80 N/mm^2 and 100 N/mm^2 respectively. Take minimum number of teeth on pinion 16. Check your design for dynamic load and determine minimum hardness of teeth required.

OR

Q.3 (a) State the advantages and disadvantages of worm gear drives.   **04**
(b) Design a pair of bevel gears for two shafts whose axes are at right angles. Speed of **10** the pinion is 300 rpm and that of gear shaft is 120 rpm. The amount of power to be transmitted is 50 kW. The pinion is made of 55C8 steel having minimum tensile strength 687 MPa and hardness 230 BHN. The gear is made of 30C8 steel having minimum tensile strength 586 MPa and hardness 155 BHN. The gear tooth system is 20^0 full depth involute teeth. Minimum number of teeth on pinion is 16. Take service factor as 1.25 and dynamic factor C = 1116 N/mm. Initially assume mean velocity as 6.5 m/sec.

Q.4 (a) What are the functions of piston rings?   **04**
(b) Design a cast iron piston for a single acting four stroke engine for the following **10** specifications:
Cylinder bore = 100 mm, Stroke = 120 mm, Maximum gas pressure = 5 N/mm^2
Break mean effective pressure = 0.65 N/mm^2, Fuel consumption = 0.227 kg/kW/hr
Speed = 2200 rev/min.
Assume suitable data : Like
H.C.V. of fuel = 41870 kJ/kg
For C.I. piston : σ_t = 37.5 N/mm^2, C = 0.05, k = 46.6, $T_C - T_e = 220^0$ C

OR

Q.4 (a) Why 'I' section is chosen for the connecting rod of high speed I.C.Engine?   **04**
(b) Design a connecting rod completely with big and small ends, for a petrol engine from **10** the following data:
    Diameter of the piston, d = 110 mm.
    Mass of reciprocating parts, M = 2 kg.
    Length of the connecting rod, l = 325 mm.
    Stroke, L= 325 mm.
    Speed, N=1500 rpm.
    Compression ratio = 4:1.
    Max. Explosion pressure, P_r= 2.5 MPa.
    Compressive stress = 130 MPa.
    Factor of safety = 5

Q.5 (a) Explain the thermal and wear considerations in design.   **07**
(b) State and explain design consideration of casting with figure.   **07**

OR

Q.5 (a) Explain the importance of manufacturing considerations in machine design.   **07**
(b) What are the advantages and disadvantages of "Wet Liner" and "Dry Liner" in I.C. **07** engines?

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