Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. - SEMESTER – VIII EXAMINATION – OCTOBER 2012

Subject code: 181902 Date: 29/10/2012

Subject Name: Machine Design - II

Time: 02.30pm - 05.00pm Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of PSG Design Data Book is permitted in exam.**

Q.1 **(a)** A three stage gear box with twelve speeds is to be designed based on R10 series 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 1440 rpm and transmits of 5 kW. Using standard spindle speeds, **10**

1. Draw the structure and speed diagram for the arrangement.
2. Determine the ratio of the belt pulley diameters.
3. Draw the gear box layout.
4. Determine the number of teeth on each gear of the gear box.

(b) What are the basic objectives of a material handling system? **04**

Q.2 **(a)** What are the basic principles in selecting the type of material handling equipment? **06**

(b) Design a connecting rod for a petrol engine from the following data: **08**
Diameter of piston = 110 mm; Mass of reciprocating parts = 2 kg; Length of connecting rod = 325 mm; Stroke = 150 mm; Speed = 1500 rpm with possible over speed of 1850 rpm; Compression ratio = 4:1; Factor of safety = 4; Maximum explosion pressure = 5.5 MPa
Select suitable material and permissible stresses for its.

OR

(b) The cylinder of a four stroke diesel engine has the following specifications: **08**
Brake power = 7.5 kW; Speed = 1400 rpm; Maximum gas pressure = 3.5 MPa; Indicated mean effective pressure = 0.35 MPa; Mechanical efficiency = 80 %;
The cylinder liner and head are made of grey cast iron (S_{ut} = 260 MPa and μ = 0.25). The factor of safety for all parts is 6. Calculate:

1. Bore and length of the cylinder liner
2. Thickness of the cylinder liner (Take, C= 3.2 mm)
3. Thickness of the cylinder head

Q.3 A pair of parallel helical gears consists of 24 teeth pinion rotating at 5000 rpm and supplying 12 kW power to a gear. The speed reduction is 4:1. The normal pressure angle and helix angle are 20^0 and 23^0 respectively. Both gears are made of hardened steel (S_{ut} = 600 N/mm^2). The service factor and factor of safety are 1.5 and 3 respectively. Calculate **14**

1. Module and face width of gears.
2. Surface hardness for the gears assuming a factor of safety of 1.5 for wear consideration.

OR

Q.3 A pair of mating carefully cut spur gears has 20^0 full depth of 4 mm module. The number of teeth on pinion and gears are 38 and 115, respectively. The face width is 40 mm. If the pinion and gear are made of steel with $f_{b\ Static}$= 233 MPa and surface hardness of 300 BHN. Calculate the safe power that can be transmitted when the pinion is run at 1200 rpm. **14**

Q.4 It is required to design a pair of bevel gears, which are mounted on shafts intersecting at right angles. The pinion receives 20 kW power through its shaft and rotates at 720 rpm. The number of teeth on pinion and gear are 30 & 45 respectively. The pressure angle is 20° full depth teeth form. The gears are made of plain carbon steel with permissible bending stress as 200 MPa. The gears are case hardened and the surface hardness is 300 BHN. Take service factor = 1.25. **14**

OR

Q.4 A speed reducer unit is to be designed for an input of 5 kW with a transmission ratio of 25. The speed of the hardened steel worm is 1750 rpm. The worm wheel is to be made of chilled bronze. The tooth form is to be 20^0 full depths involute. Assume double start worm. Design a worm and worm wheel. **14**

Q.5 Design a plain carbon steel centre crankshaft for a single acting four stroke, single cylinder engine for the following data: **14**

Piston diameter = 250 mm; Stroke = 400 mm; Maximum combustion pressure = 2.5 MPa; Weight of the flywheel = 5 kg; Total belt pull = 100 N; Length of connecting rod = 950 mm. The flywheel is used as a pulley.

When the crank has turned through 30^0 from top dead centre, the pressure on the piston is 1 MPa and the torque on the crank is maximum.

Any other data required for the design may be assumed.

OR

Q.5 Design the various components of a valve gear mechanism for a horizontal gas engine with the following data: **14**

Diameter of port is 70 mm, its weight is 5 N, and its lift is 25 mm. The maximum combustion pressure is 4.5 MPa. The valve opens 33^0 before O.D.C. and closes 1^0 after I.D.C. and it is to open with constant acceleration and deceleration for each half of the lift. The gas pressure in cylinder when the exhaust valve start to opens is 0.34 N/mm^2 , the pressure on the top side of the valve may be taken as 0.1 N/mm^2 absolute and the greatest suction pressure is 0.035 N/mm^2 below atmospheric. The engine runs at 350 rpm. The effective length of each arm of the rocker lever is 175 mm and the included angle is 140^0.

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