Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER • 2015

Subject code: 181902 **Date:11/05/2015**

Subject Name: Machine Design- II

Time: 10.30AM-01.00PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of PSG Design Data book is permitted.**

Q.1 **(a)** A pair of spur gear with 20° full depth involutes teeth needs to be designed. Input shaft rotates at 800 rpm and receives 6 kW power. Speed reductions of output shaft by 5 times. Pinion and gear are made of steel with σ_{ut}= 450 N/ mm^2 service factor is 1.3. The gears are machined to accuracy of grade 10. Assume a pitch line velocity of 3.6 m/s and FOS is 2. Estimate the module of the gear teeth. Determine static and dynamic load from Spott's equation. Specify the surface hardness of gear teeth assuming that strength in bending is the same as strength in wear. **07**

(b) Answer the following questions. **07**

(1) What do you mean by interference and undercutting of gear? How it can be avoided?

(2) What is contact ratio? How it can be increased?

Q.2 **(a)** A pair of straight bevel gears, manufactured by generation, consists of 14 teeth pinion meshing with 85 teeth gear. The module at large end is 5.5 mm while the face width is limited to 0.25 times the slant height. The pinion is made of steel having ultimate tensile strength is 750 N / mm^2 and surface hardness of 210 BHN. The gear is made of cast iron having ultimate tensile strength 260 N / mm^2 and surface hardness of 210 BHN. The shaft angle is 90^0. If the pinion rotates at 750 rpm, estimate the power that gear pair can transmit. **07**

(b) A speed gearbox for a head stock of a lathe machine is to give speed variation from 125 rpm to 1500 rpm in 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 speed reduction 1.2:1. Find the speed steps arranged in geometric progression. Draw the structural diagram, Ray diagram and speed charts. **07**

OR

(b) Answer the following questions. **07**

(1) What are the basic considerations in design of multi speed gearbox?

(2) Which conditions should be satisfied by optimum structure diagram of multi speed gear box?

Q.3 **(a)** Following data is given for a diesel engine: **07**

Cylinder bore = 100 mm, Length of connecting rod = 350 mm, FOS = 6,
Maximum gas pressure = 4 MPa, l/d Ratio for piston pin bearing = 2,
l/d Ratio for crank pin bearing = 1.3,
Allowable bearing pressure for piston pin bearing = 12 MPa
Allowable bearing pressure for crank pin bearing = 7.5 MPa
Determine: (i) Dimensions of cross section of the connecting rod
(ii) Dimensions of small and big end bearings of connecting rod.

(b) Write the procedure to design a centre crankshaft subjected to maximum bending moment with neat sketch. **07**

OR

Q.3 **(a)** The following data is given for a single cylinder four stroke diesel engine having CI Piston: **07**
Cylinder bore = 0.30 m, Stroke length = 0.375 m, Speed = 500 rpm
Maximum gas pressure = 8 MPa, Break Mean effective pressure = 1.15 MPa
Break specific fuel consumption = 0.22 kg/ kW –h, H.C.V. of fuel = 42000 kJ/kg,
Thermal conductivity factor = 46.5 W / m ^{0}C, Allowable tensile stress = 37.5 N/ mm^2
Temperature difference between centre and edge of piston head is 220^{0}C
Assume 5% of the total heat is developed in cylinder is transmitted by piston.
Design (1) Piston Head (2) Piston pin.

(b) Answer the following questions. **07**
(i) What are the advantages and disadvantages of aluminum piston over cast iron piston?
(ii) What are the different types of piston rings? State its functions. Why is more number of thin piston rings preferred over small number of thick rings?

Q.4 **(a)** Answer the following questions. **07**
(i) What are the various factors to be consider for selecting material handling equipments for given application?
(ii) Explain the concept of material handling system design.

(b) A horizontal flat belt conveyor is used for transporting the bulk material having mass density of 2000 kg/ m^3. The surcharge factor 'C' for the flat belt is 0.075, while the belt width is 800 mm. If the belt speed is 1.75 m/s, determine the capacity of conveyor. Take width of material storage on belt as (0.9B – 0.05),m. **07**

OR

Q.4 **(a)** Design the crane hook of a hoisting block for a maximum load lifting capacity of 10 tones (98.1 kN). The material for hook is forged steel for which permissible tensile stress may be taken as 120 N/mm^2. Choose most suitable cross section for the hook. **07**

(b) Explain the construction and working of valve gear mechanism for vertical I.C. engine with neat sketch. **07**

Q.5 **(a)** A single cylinder double acting steam engine develops 150 kW at a mean speed of 80 r.p.m. The co efficient of fluctuation of energy is 0.1 and fluctuation of speed is -2% to +2% of mean speed. If the mean diameter of flywheel rim is 2 meters and the hub end spokes provides 5% of the rotational inertia of the wheel, find the mass of the flywheel and cross – sectional area of the rim. Assume the density of the CI flywheel as 7200 kg / m^3. **07**

(b) Give the classification of conveyors. What are the different types of pulley used in conveyor system? State their functions. **07**

OR

Q.5 **(a)** The following data is given for a pair of helical gears made of steel: **07**
Normal module = 5 mm, Face Width = 50 mm, No. of Pinion Teeth = 30,
No. of Gear Teeth = 60, Centre distance = 245 mm, Normal Pressure angle =20^0,
Pinion speed = 1000 r.p.m, surface hardness = 300 BHN, FOS = 2
Service Factor = 1.5, Grade of Machining = 8, Tooth form factor (Y) = 0.385
Permissible σ_b for pinion and gear material=150N / mm^2.
Determine:(i) Helix angle (ii) Beam strength
(iii) Max. static load that gear can transmit (iv) Power transmitting capacity

(b) What are the lubricants used in gear drives? Explain the modes of gear lubrications? **07**

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