Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VIII EXAMINATION – WINTER 2015

Subject Code:X81902 **Date:11/12/2015**

Subject Name: Machine Design-II

Time: 2:30pm to 5:00pm **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 in exam.**

Q.1 (a) 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, b= 10m, Pitch line velocity = 5 m/sec (For initial calculation of module), Maximum permissible error in gear tooth profile = 0.025 mm, k = A factor depending upon the form of teeth = 0.111,Velocity factor = 3/ (3 + V), where V is the pitch line velocity in m/s.

Take endurance surface hardness = 600 MPa

Lewis form factor = 0.154 – 0.912/No. of teeth for 20^0 pressure angle involute tooth system. The materials and stresses are as under:

Pinion (Fe 410):-Bending stress=135N/mm^2, E=2.1 x 10^5N/mm^2, Hardness: 260 BHN

Gear(FG 200):- Bending stress= 65 N/mm^2,E= 1.1 x 10^5N/mm^2,Hardness: 250 BHN

(b) Explain standard system of gear tooth and advantage and disadvantages of 14.5^0 and 20^0 involutes system. **04**

Q.2 (a) Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **07**

(b) Determine the power capacity of a pair of helical turning gears having a transmission ratio of 10:1. The teeth are 20º full depth involute – 6 mm module . The pinion has 25 teeth and rotates at 5000 r.p.m. The active face width is 76 mm and material is C-40 steel untreated. **07**

OR

Q.2 (b) Draw speed ray diagram and layout for a six speed gear box .The out put speed are 160 r.p.m. minimum and 1000 r.p.m. maximum. The motor speed is 1440 r.p.m. **07**

Q.3 (a) Determine the principle dimensions of cylinder for a vertical 4 stroke compression ignition engine from the following data: Brake power = 4.5 kW, Speed = 1200 rpm, Indicated mean effective pressure = 0.35 MPa, Mechanical efficiency = 80%. **07**

(b) Describe the criteria for deciding the size of suction and exhaust valve of an I.C. engine. **07**

OR

Q.3 (a) A elevator is designed to carry workers and materials to height of 40 meter. It is estimated that at least 10 workers with material load of 12 KN should be hoisted at a speed of 0.5m/sec which should be attained in the first 0.4s. The recommended steel wire rope is 6x19 with wire diameter 2.5mm. Determine factor of safety. Assume E = 84GPa, for 6x19 rope wire diameter dw=0.063d, cross sectional area =0.38d^2, ultimate tensile strength for the wire rope is 435d^2 **07**

(b) Design an overhung Crank shaft with two main bearings for an I. C. engine with the following data: **07**

i. Cylinder bore = 250 mm ii. Stroke length = 300 mm
iii. Flywheel weight = 27 kN iv. Maximum pressure = 2.5 N/mm^2
v. Maximum torque at crank rotation = 1.7 N/mm^2 30^0 the pressure at that instant

Q.4 **(a)** Discuss about various section of connecting rod. **07**

(b) Design a connecting rod for a high speed diesel engine from the following data: **07**

Cylinder bore = 100 mm, Stroke = 120 mm, Maximum speed = 1800 rpm, Compression ratio = 18,Max. Explosion pressure = 5 MPa, Mass of reciprocating parts = 3.5 Kg, Length of connecting rod = 240 mm, If the connecting rod is made of drop forged steel, determine the size of I-section, size of small end bearing, big end bearing and bolts. Assume suitable stresses.

OR

Q.4 **(a)** 1)Why an I-section is usually preferred to round section in case of connecting rods? **07**

2) What are the merits and demerits of wet and dry cylinder liners?

(b) Design a cast iron piston for single acting four stroke engine for following specification Cylinder Bore = 110 mm, Stroke = 130 mm, Maximum gas pressure = $5N/mm^2$ **07**

Brake mean effective pressure = 0.5 N/mm^2 , Fuel consumption = 0.2 kg/kw/hr, speed =2000rev/min. Assume suitable data for C.I permissible tensile stress is 40 N/mm^2, HCV=41870 KJ/kg, K for C.I. = 46.6

Permissible tensile stress or piston ring is 100 N/mm^2, permissible tensile stress for pin is 150 N/mm^2

Q.5 **(a)** Design a tubular type pushrod for operating an exhaust valve of 4 stroke I. C. engine using the following data: **07**

i. Maximum force required to open the exhaust valve = 900 N
ii. Ratio of l_p/l_w for rocker arm = 1.2
iii. Length of push rod = 110 mm
iv. Ratio of inner diameter to outer diameter for tubular push rod = 0.75
v. Required factor of safety = 04
vi. Compressive yield strength for mild steel push rod = 350 N/mm^2
vii. Modulus of elasticity for mild steel = 210×10^3 N/mm^2

(b) Explain the complete designation of steel wire ropes and various types of stresses induced in a wire rope. **07**

OR

Q.5 **(a)** Find the main dimensions of a cast iron rope drum from the following data for winding rope (two sides): **07**

i. Maximum load to be lifted = 40 kN
ii. Diameter of wire rope = 14 mm
iii. Lifting height = 10 m iv. Number of falls = 04
v. Drum diameter is 30 times rope diameter
vi. Allowable stress for cast iron = 25 MPa
vii. Use two movable sheaves.

(b) Explain classification and working of different types of conveyors. **07**

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