Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII EXAMINATION – SUMMER 2016

Subject Code:181902 **Date:05/05/2016**

Subject Name:Machine Design II

Time:10:30 AM to 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.**

Q.1 **(a)** Write a detailed note on selection of gear materials in detail. **05**

(b) Design (draw only structural diagram and speed chart) a speed gearbox for the following specifications for a head stock of a lathe machine: **09**

Motor Power = 10 Kw;
Gearbox input shaft speed = 500 r.p.m.
Maximum speed = 630 r.p.m.;
Minimum speed = 100 r.p.m.
No. of step = 9

Q.2 **(a)** Explain the effect of helix angle on power transmission capacity of helical gear. Also suggest the values of helix angle for helical gear. **05**

(b) A pair of helical gears is used in a speed reducer, driven by an I.C. engine. Pinion transmits 50 kW at 1000 r.p.m. The speed reduction is 4 : 1. Design the gear pair assuming service load factor of 1.875 for medium shock condition and continuous operation. Lewis's form factor $Y = \Pi\,[0.154 - 0.912/Z]$ and σ_{en} = 384 MPa. The other details are as below: **09**

Material	σ_b MPa	BHN
Pinion C30 forged steel	175	150
Gear cast steel	140	180

OR

(b) The following data refers to a spur gear pair: **09**

	pinion	**gear**
Material	C-50 steel	C35 Mn75 steel
Ultimate strength	700 MPa	600 MPa
BHN	240	225
Pitch diameter	48 mm	144 mm
No of teeth	24	72 (20^0 full depth)
RPM	1440	480

Service factor = 1.5 Dynamic load factor = 230 N/mm
Lewis's form factor $Y = \Pi\,[0.154 - 0.912/Z]$
Velocity factor = 3 / 3 + v
Wear factor = $0.156\,[\,BHN/\,100]^2$ MPa
Specify the kW capacity of the gear unit.

Q.3 **(a)** Explain the thermal consideration in worm and worm gears in detail. **05**

(b) Design the pair of 90^0 straight bevel gear is used to transmit 7.5 kW from the motor running at 1440 r.p.m. from the given data: **09**

Speed reduction = 4 : 1
No of teeth on pinion = 18
Pressure angle = 20^0 full depth
Design stress for C.I. gears = 55 MPa
Stress concentration factor = 1.1
service load factor = 1.5
σ_{es} = 550 MPa and take $E_p = E_g = 2.0 \times 10^5$ N/mm^2

OR

Q.3 **(a)** Explain the various gear tooth failures alongwith stating reasons and its remedies in detail. **05**

(b) The following data refers to a worm gear : **09**

Power = 15 kw
Speed of worm = 1200 rpm
Teeth on worm gear = 36 (20^0 full depth)
Tripple threaded worm
Axial pitch of the worm = 30 mm
Pitch diameter of worm = 60 mm
Coefficient of friction = 0.03
Find 1) helix angle of worm 2) speed ratio 3) center distance between two shafts 4) apparent stress in the worm gear 5) efficiency of drive.

Q.4 **(a)** Explain the design of cylinder of an I.C. engine. **05**

(b) Design a connecting rod for a single cylinder I.C. engine from the following data: **09**

Diameter of piston = 100 mm Mass of reciprocating parts = 2.25 kg
Length of connecting rod = 300 mm; Stroke = 125 mm
Speed = 1500 rpm
Compression ratio = 6 Factor of safety = 7
Maximum explosion pressure = 3.5 MPa
For connecting rod material, yield stress in compression = 330 MPa.
Density of connecting rod material = 8000 kg/m^3
Permissible whipping stress for connecting rod material = 20 MPa.
Take size of connecting rod as 5t x 4t x t.

OR

Q.4 **(a)** Explain the valves gears mechanism used in an I.C. engine with neat sketch. **05**

(b) Design a cast iron piston for a four stroke I.C. engine from the following specification : **09**

Cylinder Bore = 110 mm Stroke = 120 mm
Maximum gas pressure = 5 N/mm^2 Speed = 2000 rev/min.
Indicated mean effective pressure = 0.75 N/mm^2
Fuel consumption = 0.15 kg/BHP/hr,
Mechanical efficiency = 80 %
For C.I piston ,permissible tensile stress = 35 N/mm^2
HCV=42000 KJ/kg, K for C.I. = 46.6 W/m ^{0}c
Take $T_c - T_e = 220\ ^0$c
Permissible tensile stress for piston ring = 80 N/mm^2
Permissible bending stress for pin = 85 N/mm^2
Permissible bearing stress for pin = 20 N/mm^2

Q.5 **(a)** Explain the design of belt conveyors / screw conveyors with a neat sketch. **05**

	(b)	Design the crane hook for a maximum load lifting capacity of 100 kN . The material for hook is forged steel with permissible tensile stress 120 N/mm^2. Select the most suitable cross section for the hook.	**09**

OR

Q.5	**(a)**	Explain the basic Concepts of material handling system design in detail.	**05**
	(b)	State the main parts commonly used in materials handling equipments alongwith neat sketch. Explain the design of drum and selection of suitable wire rope in detail.	**09**

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