

GUJARAT TECHNOLOGICAL UNIVERSITY
B.E. SEMESTER VIII(OLD) EXAMINATION – WINTER 2017

Subject Code: 181902**Date: 02-11-2017****Subject: Machine Design II****Time: 02:30 pm to 05:00 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) Answer the following: **06**

1. State the advantages of steel wire ropes and explain the different types of stresses induced in it.
2. Explain the belt conveyor with neat sketch.

(b) Design a drum and select a steel wire rope for an E.O.T. crane from the following given data: **08**

- | | |
|------------------------------------|-----------------------|
| Lifting capacity = 55 kN | Height of lift = 7 m |
| Weight lifting tackle = 1.2 kN | Weight magnet = 20 kN |
| No of ropes = 4 | |
| Efficiency of pulley system = 93 % | Factor of safety = 4 |

Q.2 (a) Explain the different methods used for increasing beam strength of a gear tooth. **04**

(b) Design an eight speeds sliding gearbox for a drill press from the following data: **10**
 Minimum speed = 70 RPM Motor speed = 1440 RPM
 Maximum speed = 1800 RPM Speed of input shaft = 900 RPM
 Draw only the structural diagram and speed chart.

OR

(b) Explain the design procedure used for multi stage gear box design. **10**

Q.3 (a) Explain the factors affecting the selection of gear materials in detail. **04**

(b) Design the pair of 90° straight bevel gear is used to transmit 4 kW from the motor running at 1440 r.p.m. from the given data: **10**

- | | |
|--|--------------------------------------|
| No of teeth on pinion = 18 | Pressure angle = 20° full depth |
| Service factor = 1.1 | Speed reduction = 3 : 1 |
| Stress concentration factor = 1.1 | $E_p = 2 \times 10^5 \text{ N/mm}^2$ |
| $E_g = 1.1 \times 10^5 \text{ N/mm}^2$ | Factor of safety = 1.25 |
- The value of deformation factor C is 115 N/mm. The other details are as below:

Material	[σ_b] MPa	Hardness BHN
Pinion- steel	120	310
Gear – Castiron	80	290

OR

Q.3 (a) State the disadvantages of spur gears. List and explain the advantages of helical gears. List the few applications of helical gears. **04**

(b) A pair of spur gear is used in a speed reducer, driven by an electric motor. Pinion transmits 5 kW at 500 r.p.m. The speed reduction is 3:1. Design the gear pair assuming service factor of 1.5 for medium shock condition and continuous operation. Lewis's form factor $Y = \prod [0.154 - 0.912/Z]$ and $\sigma_{en} = 600 \text{ MPa}$. Total permissible error in tooth is 0.025 mm. Assume initially pitch line velocity

as 5 m/sec for module calculation and face width $b = 10m$. Take no of teeth on pinion = 20. Use 20° FD involute tooth profile. The other details are as below:

Material	$[\sigma_b]$ MPa	Hardness BHN
Pinion- 40C8	200	225
Gear – FG300	100	180

- Q.4 (a)** Explain the thermal consideration in Worm & Worm gear design in detail. **04**
- (b)** Design a pair of helical gears having a transmission ratio of 3.33:1. The teeth are 20° full depth involute and the helix angle is 25° . The pinion has 21 teeth and transmits 10 kW at 1000 r.p.m. The face width is 10m . Service factor is 1.5 and factor of safety is 2. Assume initially pitch line velocity as 5 m/sec for module calculation. The value of deformation factor C in Buckingham's equation is 114 N/mm. The other details are as below: **10**

Material	$[\sigma_b]$ MPa	Hardness BHN
Pinion- 55C8	240	360
Gear – 40C8	194	350

OR

- Q.4 (a)** Explain different types of gear tooth failures in detail. **04**
- (b)** The following data refers to a worm & worm gear pair: **10**
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|--|--------------------------------|
| Worm – triple threaded | Worm speed =1200 rpm |
| Power = 15 kW | Teeth on worm gear = 36 |
| Tooth profile - 20° full depth involute | Coefficient of friction = 0.03 |
| Axial pitch of worm = 30 mm | Pitch diameter of worm = 60 mm |
- Calculate:
- Helix angle of worm
 - Speed ratio
 - Centre distance
 - Efficiency of the drive
 - Apparent stress in worm gear teeth.

- Q.5 (a)** Explain the design of flywheel with a neat sketch. **04**
- (b)** The cylinder of a four stroke diesel engine has the following specifications: **10**
- | | |
|--------------------------------|------------------------------|
| Brake power = 7.5 kW | Speed = 1400 rpm |
| Maximum gas pressure = 3.5 MPa | Mechanical efficiency = 80 % |
- Indicated mean effective pressure = 0.35 MPa;
 The cylinder liner and head are made of grey cast iron ($S_{ut} = 260$ MPa and $\mu = 0.25$). The factor of safety for all parts is 6.
 Calculate:
- Bore and length of the cylinder liner
 - Thickness of the cylinder liner (Take, $C = 3.2$ mm)
 - Thickness of the cylinder head

OR

- Q.5 (a)** Explain the wet and dry cylinder liners used in an I.C engine with neat sketch. **04**
- (b)** Design a cast iron piston for single acting four stroke engine for following specification : **10**
- | | |
|--|---|
| Cylinder Bore = 110 mm, | Stroke = 130 mm, |
| Maximum gas pressure = 5 N/mm ² | Brake mean effective pressure = 0.5 N/mm ² |
| Fuel consumption = 0.2 kg/kw/hr | Speed = 2000 rev/min. |
| HCV= 41870 KJ/kg | Constant K for C.I. = 46.6 W/m ⁰ C |
- For C.I piston, permissible tensile stress = 40 N/mm²
 Permissible tensile stress or piston ring = 100 N/mm²
 permissible tensile stress for pin = 150 N/mm²
