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Paper Id: | 1 | 4 | 0 | 6 | 0 | 5 | **Roll No.** | | | | | | | | | | |

B TECH
(SEM VI) THEORY EXAMINATION 2017-18
MACHINE DESIGN-II

Time: 3 Hours   *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Design data book is allowed.

SECTION A

1.   Attempt *all* questions in brief.   2 x 10 = 20

a.   What is law of gearing?
b.   What do you understand by formative numbers of teeth for helical gear?
c.   What is interference and how it can be avoided in gears?
d.   Define following for bevel gear
      (i)   Pitch cone   (ii) Pitch cone distance
e.   Explainself-locking in worm drive. Also write the condition for self-locking.
f.   Why Rolling contact bearing are called anti friction Bearing?
g.   What is bearing modulus for journal bearing?
h.   Distinguish between hydrodynamic and hydrostatic bearing.
i.   What are two type of piston rings used for piston of IC engine?
j.   What are the materials used for manufacturing of connecting rod of IC engine?

SECTION B

2.   Attempt any *three* of the following: 10 x 3 = 30

a.   What are the forces that act on the helical gear? Discuss the force analysis of helical gear.
b.   Draw a neat sketch of bevel gear showing its main elements. Also derive the Lewis equation for the bevel gear.
c.   Define the following terms in reference of ball bearing:i)Rated life of ball bearing, ii) Basic dynamic capacity (iii) Static load capacity (iv) Equivalent dynamic load (v) Cubic mean load
d.   How the journal bearing support the load (working of Journal bearing) and what are regimes of hydrodynamic lubrication?
e.   A cast iron piston for a single acting 4 stroke engine with the following specification: Cylinder bore = 150 mm, Stroke length = 175 m, Maximum gas pressure= 7MPa, Brake mean effective pressure = 0.75 MPa, Fuel consumption = 0.227Kg/kW/hr, Speed = 2200 rpm. Find the suitable thickness of the piston head. Thermal conductivity for C.I 46J/sec. m °C and   allowable temperature difference is 222°C.

SECTION C

3.   Attempt any *one* part of the following: 10 x 1 = 10

(a)   A herringbone gear pair is to be used as a single stage speed reducer for transmitting 27 kW power from the pinion rotating at 300 rpm to a gear. The reduction ratio is 3.8. The tooth system is 20° stub tooth involute, while helix angle is 30°. The face width of the pinion should not exceed twice the pitch diameter. Design the gear pair.

(b) A pair of straight teeth spur gears having 200 full depth involute pairs is to transmit 15 kW power at 300 rpm of the pinion. The speed ratio is 3:1. The number of teeth on pinion is 16 while the face width is 14 times the module. Assuming the steady load and 8-10 hours of service per day, design the gear pair.

Parameters	C.I. gear	Steel pinion
Allowable static stress,MPa	60	105
Surface endurance strength,MPa	600	600
Modulus of elasticity,kN/m^2	100	200

4. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) Design a worm gear reducer to transmit 15 kW power from a shaft rotating at 1200 rpm to another shaft, which is 0.3 m apart. The speed reduction is 10.5: 1 and teeth are 20º full depth involute.

(b) A pair of cast iron bevel gears connects two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth profiles of the gears are of 14 1/2º composite form. The allowable static stress for both the gears is 55 MPa. If the pinion transmits 2.75 kW at 1100 r.p.m., find the module and number of teeth on each gear from the standpoint of strength and check the design from the standpoint of wear. Take surface endurance limit as 630 MPa and modulus of elasticity for cast iron as 84 kN/mm2

5. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) Select a suitable single row deep groove ball bearing for the following application: Radial load = 4500 N, Axial load = 55000 N, Speed = 1500 RPM Average bearing life = 5 years running for 12 hours per day. Assume light shock loads.

(b) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and 0.5 kN load for remaining time of cycle. If the total life expected for the bearing is 20X 106 revolutions at 99 per cent reliability, calculate dynamic load rating of the ball bearing.

6. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) The load on the journal bearing is 150 kN due to turbine shaft of 300 mm Diameter running at 1800 rpm Determine the following: 1. Length of the bearing if the allowable bearing pressure is 1.6 N/mm2, and 2. Amount of heat to be removed by the lubricant per minute if the bearing temperature is 60°C and viscosity of the oil at 60°C is 0.02 kg/m-s and the bearing clearance is 0.25 mm

(b) Design a bearing and journal to support a load of 6.5 kN at 850 rpm using a hardened steel journal and bronze backed babbit bearing. Oil rings lubricate the bearing. Take room temperature as 22°C and oil temperatureas85°C.

7. **Attempt any *one* part of the following:**   **10 x 1 = 10**

   (a)   Design a connecting rod a single acting 4 stroke petrol engine with the following specification: Cylinder bore = 100mm,Stroke length = 150 mm, Length of connecting rod= 300 mm, maximum weight of reciprocating part = 20N, Maximum pressure = 2.5MPa,Compression ratio= 4,Speed = 1500 rpmPossible over speed=2500rpm, Assume suitable data.

   (b)   The bore of a cylinder of the four-stroke diesel engine is 150 mm. The maximum gas pressure inside the cylinder is limited to 3.5 MPa. The cylinder head is made of grey cast iron FG 200 (Sut = 200 N/mm2) and the FOS is 5. Determine the thickness of the cylinder head. Studs is made of steel FeE 250 (Syt = 250 N/mm2) and the FOS is 5. Calculate:

      i.   Number of studs

      ii.   Nominal diameter of studs

     iii.   Pitch of studs