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Question Paper Code : 51043

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Sixth Semester

Mechanical Engineering

080120034 — DESIGN OF TRANSMISSION SYSTEMS

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Use of Standard Design Data Book is permitted.

Assumptions and assumed data have to be stated clearly.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the advantage of belt drives over chain drives?
2. Name the different joints used to connect the ends of belts.
3. Why spur gears are noisy in operation when compared to helical gears?
4. When a spur gear is called as rack?
5. Define the term Normal Pitch in a worm gear.
6. What is difference between bevel gear formation over other type of gears?
7. What is speed diagram?
8. What is step ratio?
9. Why multiple-threaded screws are used?
10. Name the factors that decide the amount of power transmitted through a frictional clutch.

PART B — (5 × 16 = 80 marks)

11. (a) A V belt drive is to be arranged between two shafts with 1.2 m as centre distance. The driving pulley is of 250 mm effective diameter and is to be supplied with 20 kW power at 960 rpm. The follower pulley is to run at 460 rpm. Determine the number of belts required from the following :

Arc of the belt cross section – 143 mm²

Mass density of the belt material = 1000 kg/m³

Permissible tensile stress = 2 N/mm²

Co-efficient of friction = 0.30

Groove angle of the pulley = 40°.

Or

- (b) A V-belt drive is to transmit 15 kW to a compressor. The motor runs at 1150 rpm and the compressor is to run at 400 rpm. Determine
- Belt specification
 - Number of belts
 - Correct centre distance and
 - Drive pulley diameters.
12. (a) A pair of spur gears, having $14\frac{1}{2}^\circ$ involute full depth teeth is to transmit 12 kW at 300 rpm of the pinion. The velocity ratio is 3:1. The static strengths of cast iron gear and steel pinion are 60 MPa and 105 MPa respectively. Determine the module, face width and pitch diameters of the gears. Also, check the gears for wear. Modulus of elasticity of pinion and wheel are 2×10^5 MPa and 1×10^5 MPa.

Or

- (b) Design a pair of helical gears to transmit 30 kW power at a speed reduction 4:1. The input shaft rotates at 2000 rpm. Take helix and pressure angle equal to 25° and 20° respectively. The number of teeth on the pinion may be taken as 30.
13. (a) Design a pair of bevel gears to transmit 18.75 kW at 600 rpm of pinion. The velocity ratio to be about 3 and the pinion should have 20 full depth 20° involute teeth. Find the module, face width diameter of the gears and pitch cone angle for both gears.

Or

- (b) A speed reducer unit is to be designed for an input of 11.25 kW with a transmission ratio of 20. The speed of the hardened steel worm is 1500 rpm. The worm wheel is to be made of bronze. The tooth form is to be 20° involute.

14. (a) Draw the kinematic diagram and speed diagram of a head stock gear box of a turret lathe having arrangement for 9 spindle speeds ranging from 31.5 rpm to 1050 rpm. Calculate the number of teeth on each gear. Minimum number of teeth on a gear is 20. Also find percentage deviation of speed.

Or

- (b) In a drilling machine, 12 different speeds ranging from 100 rpm to 355 rpm are required. Design a three stage gear box with a standard step ratio. Sketch the layout of the gear box indicating the number of teeth in each gear. The gear box receives 5 kW from an electric motor running at 360 rpm. Sketch the speed diagram also.
15. (a) A screw jack is to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 200 MPa and in shear 120 MPa. The material for nut is phosphor-bronze for which the elastic limit may be taken as 100 MPa in tension, 90 MPa in compression and 80 MPa in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm². Design the screw, nut and handle of the jack.

Or

- (b) A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100 kW at 2400 rpm and maximum torque, 500 Nm. The outer radius of the friction plate is 25% more than the inner radius. The intensity of pressure between the plates is not to exceed 0.07 N/mm². The coefficient of friction may be assumed equal to 0.3. The helical springs required by this clutch to provide axial force necessary to engage the clutch are 8. If each spring has stiffness equal to 40 N/mm, determine the dimensions of the friction plate and initial compression in the springs.