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Question Paper Code : 20817

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Sixth/Seventh Semester

Mechanical Engineering

ME 6601 – DESIGN OF TRANSMISSION SYSTEM

(Common to: Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering)

(Regulations 2013)

(Also Common to: PTME 6601 – Design of Transmission System for B.E. (Part – Time) Fifth Semester – Mechanical Engineering – Regulations – 2014)

Time : Three hours Maximum : 100 marks

(Use of approved design data book is permitted.)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the four types of belts used for transmission of power.
2. When do you use stepped pulley drive?
3. State the advantages of toothed gears over the other types of transmission systems.
4. Why pinion is made harder than gear?
5. List the forces acting on bevel gears.
6. What is irreversibility in worm gear?
7. Define progression ratio.
8. List out the all possible arrangements to achieve 16 speed gear box
9. Name few commonly used friction materials.
10. What do you meant by self-locking brake?

PART B — (5 × 13 = 65 marks)

11. (a) A nine speed gear box used as a headstock gear box of a turret lathe is to provide a speed range of 180 rpm to 1800 rpm. Using standard step ratio, draw the speed diagram, and the kinematic lay out. Also find and fix the number of teeth on all gears.

Or

(b) Sketch the speed diagram and the kinematic layout for an 18 speed gear box for the following data: Motor speed = 1440 rpm, minimum output speed = 16 rpm, maximum output speed = 800 rpm, arrangement 2×3×3. List the speeds of all the shafts when the output speed is 16 rpm.

12. (a) Select a High speed duck flat belt drive for a fan running at 360 rpm which is driven by 10 kW, 1440 rpm motor. The belt drive is open type and space available for a center distance of 2 m approximately. The diameter of the driven pulley is 1000 rpm.

Or

(b) A Centrifugal pump running at 340 rpm is to be driven by a 100 kW motor running at 1440 rpm. The light duty drive is to work for atleast 20 hours every day. The center distance between the motor shaft and the pump shaft is 1200 mm. Suggest a suitable multiple V belt drive for this application.

13. (a) A Compressor running at 300 rpm is driven by a 15 kW, 1200 rpm motor through a 14½° full depth spur gears. The center distance is 375 mm. The motor pinion is to be of C30 forged steel hardened (BHN 250) and tempered, and the driven gear is to be of cast iron. Assuming medium shock condition and minimum number of teeth as 18, design the gear drive completely.

Or

(b) Design a carefully cut helical gear to transmit 15 kW at 1400 rpm to the following specifications. Speed reduction is 3. Pressure angle is 20°, Helix angle is 15°. The material for both the gears is C45 steel. Allowable static stress is 180 N/mm^2, surface endurance limit 800 N/mm^2. Young's modulus of the material = 2×10^5 N/mm^2. Assume minimum number of teeth as 20 and medium shock conditions. v = 15 m/s.

14. (a) Design a pair of bevel gears to transmit 10kW at a pinion speed of 1440 rpm. Required transmission ratio is 4. Material of gears is 15 Ni 2Cr 1 Mo 15 steel (BHN = 400). The tooth profiles of the gears are of 20° composite form. Assume minimum number of teeth as 20,v = 5m/s and medium shock Conditions.

Or

(b) A hardened steel worm rotates at 1440 rpm and transmits 12 kW to a phosper bronze gear. The speed of the worm wheel Should be 60 ±3% rpm. Design the worm gear drive if an efficiency of atleast 82% is desired. Assume q = 1, medium shock conditions v = 5 m/s, pressure angle = 20°.

15. (a) A single plate clutch transmits 25 kW at 900 rpm. The maximum pressure intensity between the plates is 85 kN/m^2. The ratio of radii is 1.25. Both sides of the plates are effective and the co efficient of friction is 0.25. Determine (i) The inner diameter of the plate and (ii) the axial force to engage the clutch. Assume theory of uniform wear.

Or

(b) Determine the capacity and the main dimensions of a double block brake for the following data: The brake sheave is mounted on the cast iron drum shaft. The hoist with its load weighs 45 kN and moves downwards with a velocity of 1.15 m/s. The pitch diameter of the hoist drum is 1.25 m. The hoist must be stopped within a distance of 3.25 m. The kinetic energy of the drum may be neglected. Assume sintered metal block shoe, equal friction force on each shoe, Continuous service and poor heat condition.

PART C — (1 × 15 = 15 marks)

16. (a) The transporter of a heat treatment furnace is driven by a 4.5 kW, 1440 rpm induction motor through a chain drive with a speed reduction ratio of 2.4. The transmission is horizontal with bath type of lubrication. Rating is Continuous with 3 shifts per day. Design the complete chain drive. Assume center distance as 500mm and service factor as 1.5.

Or

(b) A workshop crane is lifting a load of 25 kN through a wire rope and hook. The weight of the hook etc., is 15 kN. The rope drum diameter may be taken as 30 times the diameter of the rope. The load is to be lifted with an acceleration of 1m/s^2. Calculate the diameter of the wire rope. Take a factor of safety of 6 and E for the wire is 80 kN/mm^2. The ultimate stress may be taken as 1800 MPa. The cross sectional area of the wire rope may be taken as 0.38 times the square of the wire rope diameter.