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Question Paper Code: 31761

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Sixth Semester

Mechanical Engineering

01UME601 - DESIGN OF TRANSMISSION SYSTEMS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What are the different types of belts and their material used for power transmission?
2. What are the advantages of a wire rope over fibre rope?
3. State the law of gearing.
4. Why is pinion made harder than gear?
5. Name the different applications of worm gear.
6. Sketch neatly the working drawing of bevel gears in mesh.
7. Name the types of speed reducers.
8. Give the functions of gear box.
9. Classify dry and wet clutches.
10. What is a self-energizing brake? When a brake becomes self-locking?

PART - B (5 x 16 = 80 Marks)

11. (a) A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 30°. The cross-sectional area of each belt is 750 mm^2 and μ=0.12.The density of the belt material is 1.2 Mg / m^3 and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys of 300 mm diameter rotating at 1500 r.p.m. Find also the shaft speed in r.p.m. at which the power transmitted would be a maximum. (16)

Or

(b) Two shafts whose centres are 1 metre apart are connected by a V-belt drive. Thedriving pulley is supplied with 95 kW power and has an effective diameter of 300 mm. It runs at 1000 r.p.m. while the driven pulley runs at 375 r.p.m. The angle of groove on the pulleys is 40°. Permissible tension in 400 mm^2cross-sectional area belt is 2.1 MPa. The material of the belt has density of 1100 kg / m^3. The driven pulley is overhung, the distance of the centre from the nearest bearing being 200 mm. The coefficient of friction between belt and pulley rim is 0.28. Estimate: 1. The number of belts required; and 2. Diameter of driven pulley shaft, if permissible shear stress is 42 MPa. (16)

12. (a) An automotive gear box gives three forward speeds and one reverse with a top gear of unity and bottom and reverse gear ratio of approximately 3.3:1. The centre distance between the shafts is to be 110 mm approximately. Gear teeth of module 3.25 mm are to be employed. Sketch the layout of a typical constant mesh gear box for these conditions giving the number of teeth for the various gear wheels and showing closely how the different ratios are obtained. (16)

Or

(b) Sketch a section through a sliding type gear box with four forward and one reverse speeds and explain clearly how the different speed ratios will be obtained in the following cases :Gear ratio on top gear = 1:1 Gear ratio on third gear = 1.38:1 Gear ratio on second gear = 2.24 :1 Gear ratio on first gear = 3.8:1 Gear ratio on reverse gear = 3.8:1. Assumed counter shaft or layout shaft speed is half that of the engine speed and the smallest gear is not to have less than 15 teeth. (16)

13. (a) A pair of cast iron bevel gears connect 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 14.5º 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/mm^2. (16)

Or

(b) A triple threaded worm has teeth of 6 mm module and pitch circle diameter of 50 mm. If the worm gear has 30 teeth of 14½° and the coefficient of friction of the worm gearing is 0.05, find 1. the lead angle of the worm, 2. Velocity ratio, 3. centre distance, and 4. Efficiency of the worm gearing. (16)

14. (a) The following particulars of a single reduction spur gear are given :

Gear ratio =10 : 1; Distance between centres =660 mm approximately; Pinion transmits 500kW at 1800 r.p.m.; Involute teeth of standard proportions (addendum =m) with pressure angle of 22.5°; Permissible normal pressure between teeth =175 N per mm of width. Find :

The nearest standard module if no interference is to occur;

The number of teeth on each wheel;

The necessary width of the pinion; and

The load on the bearings of the wheels due to power transmitted. (16)

Or

(b) A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth have 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4. (16)

15. (a) A single cylinder double acting steam engine develops 150 kW at a mean speed of 80 r.p.m. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is ± 2% of mean speed. If the mean diameter of the flywheel rim is 2 metres and the hub and spokes provide 5 percent of the rotational inertia of the wheel, find the mass of the flywheel and cross-sectional area of the rim. Assume the density of the flywheel material (which is cast iron) as 7200 kg / m^3. (16)

Or

(b) A single cylinder double acting steam engine delivers 185 kW at 100 r.p.m. The maximum fluctuation of energy per revolution is 15 per cent of the energy developed per revolution. The speed variation is limited to 1 per cent either way from the mean. The mean diameter of the rim is 2.4 m. Design and draw two views of the flywheel. (16)