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M.E. / M.TECH. DEGREE EXAMINATIONS, MAY/JUNE 2017
SECOND SEMESTER

COMPUTER AIDED DESIGN

CD16204 – INTEGRATED MECHANICAL DESIGN
(Regulation 2016)

Q. Code: 895000

Time: Three Hours **Maximum : 100 Marks**

(Use of Approved Design Data Book is Permitted)

Answer **ALL** questions

PART A - (10 X 2 = 20 marks)

1. State Rankine's theory of failure.
2. Which type of fit will you recommend for the following:
   (a) Gear box shaft housing (b) Spigot and location fit
   (c) Turbo-generator bearing (d) Keyed shaft
3. What types of stresses are induced in shafts?
4. Why hollow shaft has greater strength and stiffness than the solid shaft of equal weight?
5. What are the advantages of helical gear over spur gear?
6. Why is dedendum value more than addendum value?
7. State the advantage of worm gear drive in weight lifting machines.
8. What do you mean by self-enerzing brake and a self-locking brake?
9. Why should the temperature rise be kept within the permissible range in brakes?
10. Give the reason for left and right shoes of the internal expansion brakes having different actuating forces.

PART B - (16+16+48 = 80 marks)

11. (a) A horizontal nickel steel shaft rests on two bearings, A at the left and B at the right end and carries two gears C and D located at distances of 250 mm and 400 mm respectively from the centre line of the left and right bearings. The pitch diameter of the gear C is 600 mm and that of gear D is 200 mm. The distance between the centre line of the bearings is 2400 mm. The shaft transmits 20 kW at 120 rpm. The power is delivered to the shaft at gear C and is taken out at gear D in such a manner that the tooth pressure F_{tC} of the gear C and F_{tD} of the gear D act vertically downwards. Find the diameter of the shaft, if the working stress is 100 MPa in tension and 56 MPa in shear. The gears C and D weighs 950 N and 350 N respectively. The combined shock and fatigue factors for bending and torsion may be taken as 1.5 and 1.2 respectively. **(16)**

(OR)

(b) In a drilling machine, 12 different speeds in the range of 100 rpm and 355 rpm are required. Design a three stage gear box with a standard step ratio. Sketch the layout of the gearbox, indicating the number of teeth on each gear. The gear box receives 5 KW from an electric motor running at 360 rpm. Sketch also the speed diagram. **(16)**

12. (a) A rope drum of an elevator having 650 mm diameter is fitted with a brake drum of 1 m diameter. The brake drum is provided with four CI brake shoes each subtending an arc of 45°. The mass of the elevator when loaded is 2000 kg and moves with a speed of 2.5 m/s. The brake has a sufficient capacity to stop the elevator in 2.75 meters. Assume the coefficient of friction between the brake drum and shoes as 0.2, find (i) Width of the shoe, If the allowable pressure on the brake shoe is limited to 0.3 MPa and (ii) Heat generated in stopping the elevator. **(16)**

(OR)

(b) A vehicle of mass 1200 kg is moving down the hill at a slope of 1: 5 at 72 km/h. It is to be stopped in a distance of 50 m. If the diameter of the tyre is 600 mm, determine the average braking torque to be applied to stop the vehicle, neglecting all the frictional energy except for the brake. If the friction energy is momentarily stored in a 20 kg cast iron brake drum, what is average temperature rise of the drum? The specific heat for cast iron may be taken as 520 J/kg°C. Determine, also, the minimum coefficient of friction between the tyres and the road in order that the wheels do not skid, assuming that the weight is equally distributed among all the four wheels. **(16)**

13. (a) The following data relate to a hoist: **(48)**

The maximum weight of the unloaded cage is equal to 544 kg and weight of the rope to be balanced in 7% of the weight of the cage. A speed of 3 m/s is to be reached while traveling at a distance of 18 m from rest. The sheave is carried on 2 similar (RSJ) rolled steel joists, where the centre distance is 350mm. the location of the sheave on the middle of the beam of span 4 m. Design the following:

(i) Counter weight	(ii) Wire rope	(iii) Sheave
(iv) Shaft	(v) V-Belt	(vi) Motor

(OR)

(b) A two stage reduction drive is to be designed to transmit 2 kW, the input speed being 960 rpm and overall reduction ratio is 9. The drive consists of straight tooth spur gear only. The shaft being spaced at 200 mm apart and the input and output shafts are coaxial. The shafts are supported on roller bearing and the taper keys are used for the assembly. Design the components involved in the above assembly. **(48)**