KUMARAGURU
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Register Number: ………………..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Sixth Semester

MECHANICAL ENGINEERING

MEC117:Design of Transmission Systems

(PSG Design Data book may be permitted)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   In a flat belt drive, the belt can be subjected to a maximum tension (T) and centrifugal tension (TC). The condition for transmission of maximum power is given by

    a)   T = TC
    b)   T = 2 TC

    c)   T = 3 TC
    d)   T= 3√TC

2.   Ropes fail mainly by

    a)   Fatigue
    b)   Creep

    c)   Wear
    d)   Both a and b

3.   Law of gearing is satisfied if

    a)   Two surfaces slide smoothly
    b)   Common normal at the point of contact passe through pitch point on the line joining the centres of rotation

    c)   Addendum is greater than dedendum
    d)   All the above

4.   The helix angle for double helical gears may be made upto

    a)   60°
    b)   45°

    c)   30°
    d)   90°

5.   Which type of gear will be used for non-intersecting perpendicular shafts

    a)   helical gears
    b)   worm gears

    c)   hypoid gears
    d)   herringbone gears

6.   The number of starts on the worm for a velocity ratio of 40 should be

    a)   Double
    b)   Single

    c)   Triple
    d)   Quadruple

7. A gear box is to be designed to provide 12 output speeds ranging from 160 to 2000 rpm. The spindle speeds are selected from --------------- series

a) R5
b) R10
c) R20
d) R40

8. In gear box H.P. is called by

a) Hydraulic & Pneumatic
b) High Pressure
c) High Power
d) Harmonic Progression

9. The torque developed by a disc clutch is given by

Where   W = Axial force with which the friction surfaces are held together;

μ = Coefficient of friction; and

R = Mean radius of friction surfaces.

a) $T = 0.25 \, \mu.W.R$
b) $T = 0.5 \, \mu.W.R$
c) $T = 0.75 \, \mu.W.R$
d) $T = \mu.W.R$

10. The brakes commonly used in railway train is

a) Shoe brake
b) Band brake
c) Band and block brake
d) Internal expanding brake

PART B (10 x 2 = 20 Marks)

11. Sketch the cross-section of a V-belt and label its important parts.
12. What do you understand by simplex, duplex and triplex chains?
13. What is pressure angle? What is the effect of increase in pressure angle?
14. What is a herringbone gear? Where they are used?
15. Differentiate an angular gear and mitre gear.
16. Why the efficiency of a worm gear drive comparatively low?
17. Draw the ray diagram of 6 speed gear box
18. Why G.P. series is selected for arranging the speeds in gear box?
19. Why it is necessary to dissipate the heat generated when clutches operate?
20. What is meant by self energizing brake?

PART C (5 x 14 = 70 Marks)

21. a)   Find the width of the belt, necessary to transmit 7.5 KW to a pulley 300 mm diameter, if the pulley makes 1600 rpm and the coefficient of friction between the belt and the pulley is 0.22. Assume the angle of contact as 210° and the maximum tension in the belt is not to exceed 8 N/mm width.

b) Select a suitable wire rope to lift a load of 10 kN of debris from a well 60 m deep. The rope should have a factor of safety equal to 6. The weight of the bucket is 5 kN. The load is lifted up with a maximum speed of 150 metres/min which is attained in 1 second.

22. a) A compressor running at 300 r.p.m. is driven by 15 kW, 1200 r.p.m. motor through a 14.5° full depth spur gears. The centre distance is 375 mm. the motor pinion is to be of C30 forged steel hardened and tempered, and the driven gear is to be of cast iron. Assuming medium shock condition, design the gear drive completely

(OR)

b) A pair of parallel helical gears consists of a 23 teeth pinion meshing with a 46 teeth gear. The helix angle is 24° and the normal pressure angle is 21°. The normal module is 4 mm. Calculate:

1. The transverse module

2. The transverse pressure angle

3. The axial pitch

4. The pitch circle diameters of the pinion and the gear

5. The centre distance

6. The addendum and dedendum circle diameters of the pinion

23. a) A pair of bevel gears is transmitting 5 kW at 360 rpm of the pinion, with a reduction ration of 4. Design the pair by assuming suitable material.

(OR)

b) Design 20° involute worm and gear to transmit 10 kW with worm rotating at 1400 r.p.m. and to obtain a speed reduction of 12 : 1. The distance between the shafts is 225 mm.

24. a) Draw the kinematic arrangement and the speed diagram of the headstock 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 if the minimum number of teeth on a gear is 25.

(OR)

b)   Design the layout of a 12 speed gear box for a lathe. The minimum and maximum speeds are 100 rpm and 355 rpm. The gear box receives 5 kW from an electric motor running at 360 rpm. Construct the speed diagram using a standard step ratio. Sketch the layout of gear box, indicating the number of teeth on each gear

25. a)   Design a single plate automobile clutch to transmit a maximum torque of 250 N-m at 2000 r.p.m. The outside diameter of the clutch is 250 mm and the clutch is engaged at 55 km/h. Find: 1. the number of revolutions of the clutch slip during engagement; and 2. heat to be dissipated by the clutch for each engagement. The following additional data is available: Engine torque during engagement = 100 N-m; Mass of the automobile = 1500 kg; Diameter of the automobile wheel = 0.7 m; Moment of inertia of combined engine rotating parts, flywheel and input side of the clutch = 1 kg-m^2; Gear reduction ratio at differential = 5; Torque at rear wheels available for accelerating automobile = 175 N-m; Coefficient of friction for the clutch material = 0.3; Permissible pressure = 0.13 N/mm^2.

(OR)

b)   An internal expanding shoe brake actuated mechanically by cam and lever. Mechanism has the following dimensions. Diameter of the drum = 280 mm, Distance between the fulcrum centre = 75 mm, Distance of fulcrum centers and that of cam axis, both from the drum centre = 115 mm, Distance of line of action of braking force from the cam axis = 100 mm, Distance between the points where the cam acts on the two brake shoes = 30 mm. Each shoe subtends an angle of 90 deg. At the drum centres. If the braking force is 500 N and the coefficient of friction is 0.3, find the braking torque on the drum. Assume that the reactions between the brake shoes and the drum pass through the point's bisecting the contact angle. Also assume that force exerted by the cam ends on the two shoes is equal.

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