

M.E. DEGREE EXAMINATIONS: JANUARY 2011

First Semester

CAD/CAM

CCM504: Advanced Mechanical Design

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. What is meant by interference fit?
2. What is meant by interchangeability?
3. What is meant by torsional stiffness?
4. State Rankines theory.
5. State law of gearing.
6. What is meant by kinematic arrangement?
7. Explain the function of over running clutch.
8. What are the advantages of multiplate clutch?
9. Define coefficient of friction.
10. Write the classification of brakes.

PART B (5 x 16 = 80 Marks)

11. (a) Describe the six identified stages of the design process. How are these related to CAD?

(OR)

- (b) Compare the weight, strength and stiffness of a hollow shaft of the same internal diameter as that of a solid shaft. The inside diameter of the hollow shaft is being 0.6 times the external diameter. Both the shafts have same materials and length.

12. (a) A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of the left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25KN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and the $\mu=0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63N/mm^2 in tension and 42N/mm^2 in shear for the material of the shaft. Assume that the torque on one pulley is equal to that on the other pulley.

(OR)

- (b) A shaft 50 mm diameter having simply supported in bearings 2.25 m apart is keyed with two pulleys weighing 550N and 350N respectively at 0.5 m and 1.5 m from the left end. Assuming the shaft material as C45. Determine the power that can be transmitted with a factor of safety of 2. Assume the speed to be 1000 rpm. Check the design for rigidity and critical speed.

13. (a) A pair of bevel gears is transmitting 5kW at 360 rpm of the pinion, with a reduction ration of 4. Design the pair assuming suitable material and sketch the free body diagram of the gear .Indicate the force components.

(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.

14. (a) A multi disc clutch has three discs on the driving shaft and 2 on the driving shaft, the inside diameter of the contact surface is 120 mm. The axial intensity of pressure is limited to 0.1 N/sq.mm. Design the clutch for transiting 25 KW at 1575 rpm. Assume uniform wear and take the coefficient of friction is 0.3.

(OR)

- (b) A centrifugal clutch is to transmit 15 kW at 900rpm. The shoes are 4 in number. The speed at which the engagement begins is $3/4^{\text{th}}$ of the running speed. The inside radius of the pulley rim is 150 mm. Centre of gravity of the shoe lies at 120mm from the centre of the spider. The shoes are lined with ferrods for which the co-efficient of friction may be taken as 0.25. Determine Mass of the shoes and size of the shoes if angles subtended by the shoes at the centre of the spider are 60° and the pressure exerted of the shoes is 0.1 N/mm².

15. (a) In a band and block brake, the band is lined with 14 blocks, each of which Subtends an angle of 20 deg, at the drum centres. One end of the band is attached to the fulcrum of the brake lever and the other to a pin 150 mm from the fulcrum. Find the force required at the end of lever 1 meter long from the fulcrum to give a torque of 4 kN m. The diameter of the brake drum is 1 meter and $\mu = 0.25$.

(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.
