

**Agricultural Engineering Branch**

**III SEMESTER – (REGULATIONS 2008)**

**AI 9202 – THEORY OF MACHINES**

Time: 3 hours

Maximum marks: 100.

**PART – A**

**(10 x 2 = 20 Marks)**

1. What is the difference between radial and cylindrical cam
2. Write the expression for maximum velocity and maximum acceleration , when the follower moves with Uniform Acceleration and Retardation
3. Find the number of instantaneous centre for six bar mechanism.
4. Define Grashof's Law
5. What is the difference between flat belt and V-belt drives?
6. What are the functions of clutches
7. What is meant by speed ratio and train value in simple gear train.
8. What is meant by arc of contact and contact ratio in gears
9. Write an expression for power absorbed in friction using wear theory for multiple collar flat bearing?
10. Write an expression for total torque transmitted in multi collared bearing using uniform pressure theory?

**PART – B**

**(5 x 16 = 80 Marks)**

11. In a four-bar mechanism ABCD, the link lengths are as follows: input PQ = 40mm, coupler QR = 150mm, output RS = 80mm and frame PS = 150mm. The angle between the frame and the input is 60°. The input link PQ rotates at 120rpm clockwise direction. Sketch the mechanism and determine the velocity and acceleration of the midpoint of the link QR. Also, find the angular velocity and angular accelerations of the links QR and RS.

12.(a) Describe with neat sketch , Conical pivot bearing and derive the expression for total torque .

(OR)

12. (b) Derive the expression for total torque acting on the flat pivot bearing.

13. (a) A pulley is driven by a flat belt, the angle of lap being  $120^\circ$ . The belt is 100mm wide and 6mm thick and density  $100\text{Kg/m}^3$ . If the coefficient of friction is 0.3 and maximum stress in the belt is not to exceed 2MPa, find the greatest power which the belt can transmit and the corresponding speed of the belt.

(OR)

13.(b) Two pulleys , one 450mm diameter and the other 200mm diameter are on parallel shafts 1.95m apart and are connected by a crossed belt. Find the length of the belt required and angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200rev/min, if the maximum permissible tension in the belt is 1kN, and the coefficient of friction is 0.25

14.(a) A cam is to give the following motion to the knife edge follower. It lifts the follower through 37.5mm during its  $60^\circ$  rotation with SHM. The follower remains at rest for the next  $40^\circ$  rotation of the cam. Then it descends to its original during  $90^\circ$  rotation of the cam with SHM. The follower remains at rest for the rest of the rotation. Draw the profile of the cam if the line of stroke of the follower passes through the axis of the cam shaft. Minimum radius of the cam is 50 mm.

(OR)

14.(b) It is required to set out the profile of a cam to give the following motion to the reciprocating follower with a flat faced follower. Follower to have a stroke of 20 mm during  $120^\circ$  of cam rotation. Follower to dwell for  $30^\circ$  of cam rotation. Follower to return for remaining  $90^\circ$  of cam rotation. Follower to dwell for remaining  $90^\circ$  of cam rotation. Minimum radius of the cam is 25mm; the outstroke of the follower is performed with S.H.M. and return stroke with equal acceleration and retardation.

15.(a) Two mating gears have 20 and 40 involute teeth of module 10mm and  $20^\circ$  pressure angle. The addendum on each wheel is to be made of such length that the line of contact on each side of the pitch point has 40% the maximum possible length. Determine the addendum height for each wheel, length of path of contact, arc of contact and contact ratio.

(OR)

15.(b) In an engine governor of the Porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are  $30^\circ$  and  $40^\circ$ , find taking friction into account, range of speed of the governor.