



KERALA AGRICULTURAL UNIVERSITY
B. Tech. (Agrl. Engg.)
II Semester Final Re - Examination – August 2025
2023 & Previous Admissions

Fpme.1202

Theory of Machines (2+0)

Marks: 50
Time: 2 hours

I State True or False

(10x1=10)

1. A circular bar moving in a round hole is an example of partially constrained motion.
Fill in the blanks
2. The Whitworth type mechanism commonly used in shaper machine is called
3. When two links have point or line contact while in motion, the pair so formed is known as
4. type of gear system is used to convert rotational motion into linear motion.
5. The curved path traced by a free end of a thread as it is unwound is called
6. When a governor fluctuates continuously above and below the mean speed, the condition is called
7. Static balancing involves balancing of
8. In spur gears, the circle on which the involute is generated is known ascircle.
9. Effort of a governor is the force exerted by the governor on the
10. In a crossed belt drive, the velocity ratio of the two pulleys is proportional to their diameters.

II Write short notes on ANY FIVE of the following

(5x2=10)

1. Differentiate between the terms pitch circle and circular pitch.
2. What is instantaneous centre of rotation? How many instantaneous centre of rotation a body can have at any given instant?
3. Differentiate between static and dynamic balancing.
4. An epicyclic gear train consists of an arm and two gears A and B having 20 and 40 teeth respectively. Determine the rpm of the gear A if the gear B is fixed and the arm rotates at 50 rpm.
5. Give the mathematical relation used to determine torque transmitted by a multi-plate clutch clearly mentioning the various parameters involved.
6. Calculate the sensitivity of a Porter governor, if each of the arms is 180 mm long. The minimum radius of rotation is 100 mm when the speed is 172 rpm. The radius of rotation is 140 mm at the top speed of 206 rpm.
7. What is creep in belts? What are the parameters on which this depends?

III Answer ANY FIVE of the following

(5x4=20)

1. A flywheel absorbs 24 kJ of energy on increasing its speed of 210 rpm to 214 rpm. Predict the kinetic energy at 250 rpm.
2. For a simple harmonic motion of the follower, derive expressions for the maximum velocity and maximum acceleration during return stroke and outstroke.
3. An open belt drive connects two pulleys 120 cm and 50 cm in diameter, on parallel shafts 4 m apart. The maximum tension in the belt is 1855.3 N. The coefficient of friction is 0.3. The driver pulley of diameter 120 cm runs at 200 rpm. Calculate the power transmitted.

4. In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Length of the slotted bar is 450 mm. Find:
 - a) Inclination of the slotted bar with the vertical in the extreme position
 - b) Time ratio of cutting stroke to the return stroke
 - c) Length of the stroke.
5. In a thrust bearing, the external and internal diameters of the contacting surfaces are 320 mm and 200 mm respectively. Total axial load is 80 kN and the intensity of pressure is 350 kN/m^2 . The shaft rotates at 400 rpm. Taking the coefficient of friction as 0.06, calculate the power lost in overcoming the friction. Also calculate the number of collars required for the bearing.
6. The maximum power transmitted by a belt is 60 kW. The belt is 250 mm wide and 10 mm thick and weighs 9.81 kN/m^3 . If the ratio of tensions in the tight and slack sides is 2, determine the maximum stress induced in the belt.
7. A circular disc mounted on a shaft carries three attached masses of 4 kg, 3 kg and 2.5 kg at radial distances of 75 mm, 85 mm and 50 mm and at the angular position of 45° , 135° and 240° respectively. The angular positions are measured counter-clockwise from the reference line along the x-axis. Determine the amount of the counter mass at a radial distance of 75 mm required for the static balance.

IV

Write an essay on ANY ONE of the following

(1x10=10)

1. The turning moment curve for an engine is represented by the equation $T = (2000 + 9500 \sin 2\theta - 5700 \cos 2\theta) \text{ N-m}$, where θ is the angle moved by the crank from inner dead centre. If the resisting torque is constant, find
 - (i) Power developed by the engine.
 - (ii) Moment of Inertia of flywheel in kg-m^2 , if the total fluctuation of speed is not to exceed 3% of mean speed which is 180 rpm.
 - (iii) Find angular acceleration of the flywheel when the crank has turned through 45° from the inner dead centre.
2. A mechanism, as shown in figure below, has the following dimensions:
 $OA = 200 \text{ mm}$; $AB = 1.5 \text{ m}$; $BC = 600 \text{ mm}$; $CD = 500 \text{ mm}$ and $BE = 400 \text{ mm}$. Locate all relevant instantaneous centres. If crank OA rotates uniformly at 120 r.p.m. clockwise, find the velocity of point D.


