PVP 19

Code: 19ME3502

III B.Tech - I Semester – Regular Examinations – JANUARY 2022

MECHANICS OF MACHINERY
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 5 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each question carries 12 marks.
4. All parts of Question paper must be answered in one place

PART – A

1. a) Differentiate between a machine and a mechanism.
   b) Explain the term kinematic link. Give the classification of kinematic link.
   c) Define "gyroscopic couple"
   d) What do you mean by dynamic balancing?
   e) What is the function of flywheel?

PART – B

UNIT – I

2. a) What is inversion of mechanism? Describe various inversions of double slider crank mechanism with sketches. 6 M
   b) Explain the working of any two inversions of a single slider crank chain with neat sketches. 6 M

OR

3. a) Explain with neat sketch the working of crank and slotted lever quick return motion mechanism. Deduce the expression for length of stroke in terms of link lengths. 6 M
   b) Draw a neat sketch and explain any one approximate straight line generating mechanism. 6 M

UNIT – II

4. a) State and explain Whitworth quick return mechanism. Also derive an equation for ratio of time taken for return strokes and forward strokes. 6 M

   b) PQRS is a four bar chain with fixed link PS. The lengths of links are: PQ = 62.5mm, QR=175mm, RS=112.5mm and PS = 200mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and find the angular velocity and angular acceleration of the link QR & RS. 6 M

OR

5. a) For the slider crank mechanism shown in fig below, determine (i) the acceleration of slider B and (ii) acceleration of point C. The crank OA rotates at 180 rpm. OA = 500mm, AB = 1500mm & AC =250mm. 6 M

   b) The lengths of crank and connecting rod of a horizontal reciprocating engine are 100mm and 500mm respectively. The crank is rotating at 400rpm. When the crank has turned 30° from the inner dead centre, find analytically, the angular velocity and angular acceleration of the connecting rod. 6 M

UNIT-III

6. a) Derive an expression for minimum number of teeth on the wheel in order to avoid interference. 6 M

   b) Two mating gears have 20 and 40 involute teeth of module 10mm and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half of the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. 6 M

OR

7. a) A cam drives a flat reciprocating follower in the following manner: (i) Follower moves outwards through a distance of 20mm with SHM during first 120°of cam rotation. Follower dwells during next 30° of cam rotation. 6 M

Follower moves inwards with SHM for next 120° of cam rotation. (ii)The follower dwells for the remaining period. Draw the profile of the cam, when minimum radius of cam is 25mm. Also calculate the maximum velocity and acceleration during outward and inward motion of the follower when the cam rotates with 200 rpm.

b) Draw the cam profile for the following data: Basic circle radius of cam = 50mm, Lift = 40mm, Angle of ascent with SHM = 90°, Angle of Dwell = 90°, Angle of descent with uniform acceleration and deceleration = 90°, speed of cam = 300 rpm, Type of follower = Roller follower (With roller radius = 10mm). 6 M

UNIT – IV

8. a) Explain the 'direct and reverse crank' method for determining unbalanced forces in radial engines. 6 M

b) Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45^0 , 75^0 and 135^0. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. 6 M

OR

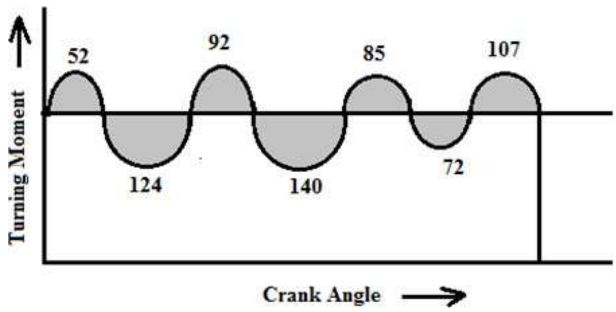
9. a) Explain the effects of gyroscopic couple on aeroplane. 6 M

b) The rotor in a ship has a mass of 3500 kg and a radius of gyration of 0.45 m. It rotates at a speed of 3000 rpm anticlockwise when looking from the bow. Find the gyroscopic couple and its effect upon the ship: i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. ii) When the ship is pitching in simple harmonic motion, the bow falls with maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees. 6 M

UNIT – V

10. a) Draw a turning moment diagram for a four-stroke compression ignition internal combustion engine and explain it. 6 M

b) The turning moment diagram shown in Figure for a multi-cylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = 3^0 horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: + 52, – 124, + 92, – 140, + 85, – 72 and + 107 mm^2, when the engine runs at a speed of 600 rpm. If the total fluctuation of speed is not to exceed ± 1.5% of the mean, find the mass of the flywheel whose radius of gyration is 0.5 m 6 M



OR

11. a) With the help of a neat sketch, explain the construction and working of a Hartnell governor. 6 M

b) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. 6 M