BRAINWARE UNIVERSITY

Term End Examination 2023
Programme – B.Tech.(ME)-2021
Course Name – Kinematics & Theory of Machines
Course Code - PCC-ME404
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Lewis equation of gears is used to determine

a) tensile stress b) compressive stress
c) contact stress d) fatigue stress

(ii) If two meshing gears have 4 : 1 gear ratio and the smaller gear has 12 teeth, the larger gear will have

a) 12 teeth b) 24 teeth
c) 36 teeth d) 48 teeth

(iii) Static balancing involves balancing of

a) forces b) forces as well as couples
c) couples d) none of the options

(iv) Dynamically unbalanced masses in rotating machines cause

a) vibrations b) friction
c) noise d) wear

(v) In a slider-crank mechanism, the maximum acceleration of slider is obtained when the crank is _____

a) at the inner dead centre position b) at the outer dead centre position
c) exactly midway position between the two dead centres d) slightly in advance of the midway position between the two dead centres

(vi) Velocity ratio is defined as the ratio of distance moved by the effort to _____

a) distance moved by load b) distance moved by energy
c) both (a) and (b) d) none of these

(vii) The property of the system which oppose a change in the output variable is represent as

a) load b) power element
c) resistance d) damping

(viii) Choose the correct option for mechanism which will have the multi degree of freedom of the system.

a) Vibrating absorber
b) A rigid body in space
c) Pure rolling of a spherical ball
d) None of these

(ix) Pitch point on a cam is

a) any point on pitch curve
b) the point on cam pitch curve having the maximum pressure angle
c) any point on pitch circle
d) the point on cam pitch curve having the minimum pressure angle

(x) The pressure angle and the base circle in a cam should be

a) both as high as possible
b) respectively as low as possible and as high as possible
c) respectively as high as possible and as low as possible
d) both as low as possible

(xi) A mass is suspended at the bottom of two springs in series having stiffness 10 N/mm and 5 N/mm. The equivalent spring stiffness of the two springs is Computed by

a) 0.3 N/mm
b) 3.3 N/mm
c) 5 N/mm
d) 15 N/mm

(xii) Motion from a gear box to differential is transmitted through _____

a) Knuckle Joint
b) Hook's Joint
c) Connecting rod
d) Oldham's coupling

(xiii) The module is defined as the reciprocal of

a) diametral pitch
b) circular pitch
c) pitch diameter
d) none of these

(xiv) Identify the point on a link connecting double slider crank chain will trace a

a) straight line
b) circle
c) ellipse
d) parabola

(xv) A mechanism with four links is classified as

a) simple mechanism
b) inversion of the mechanism
c) both (a) and (b)
d) none of these

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Identify the difference between linkage and mechanism. (3)
3. Explain the terms: (i) Module, (ii) Pressure angle, and (iii) Addendum. (3)
4. Differentiate between lower pairs and higher pairs. (3)
5. Define the terms related with Vibrations - (i) Discrete or Lumped Parameter Systems (ii) Continuous or Distributed Systems (3)
6. Deduce the relationship between circular pitch and diameter pitch of a spur gear. (3)

OR

Deduce the relationship between - (i) pitch (p) and module (m) of a Gear (ii) circular pitch and diametral pitch of a Gear. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. The arms of a Porter governor are each 200 mm long. The weight of each ball is 40 N and that of the sleeve is 200 N. The radius of rotation of the balls is 125 mm when the sleeve begins to rise and reaches a value of 150 mm for maximum speed. Estimate the speed range of the governor. If the friction at the sleeve is equivalent to 20 N of load at the sleeve, estimate how the speed range is modified. (5)

8. The turning moment diagram for a multicylinder engine shown in Fig. has been drawn to a scale of 1 mm = 5000 N-m vertically and 1 mm = 3.5^0 horizontally. The areas between output torque curve and mean resistance line taken in order from one end are: (5)

-340, +21, -245,+300, -118, +230, -225, +377 mm^2.

when the engine is running at 180 rpm. If the mass of the flywheel is 1000 kg and the total fluctuation of speed is not to exceed 3% of the mean speed, determine the minimum value of the radius of gyration.

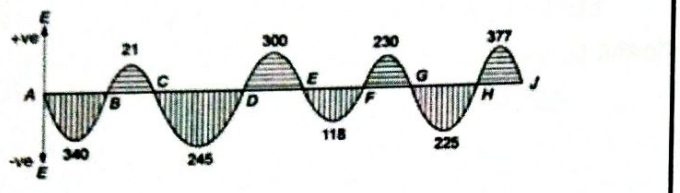

Fig. Turning moment diagram for a multi-cylinder engine

9. Enumerate the Degree of Freedom of four bar chain. (5)
10. A U-tube manometer contains a fluid of density ρ. Estimate the frequency of free oscillations of the fluid. (5)
11. A pair of gears has been designed with a velocity ratio of 3.20. The pinion has 20 teeth and the circular pitch is 78.54 mm. Evaluate: i) The number of teeth on the driven gear. ii) The module for the gears. iii) The theoretical Centre distance. (5)

12. Express the gyroscopic couple of a 3 m diameter solid aluminium alloy four-bladed propeller in which each blade has a mass of 20 kg. The test manoeuver of the airplane is a power-on flat spin in which the propeller speed is 1500 rpm and the rotation of the flat spin is 1 rad/s. The radius of gyration of the propeller with respect to the propeller axis is approximately half of the propeller radius. (5)

OR

A disc cam is to give Simple Harmonic Motion (SHM) to a knife edge follower during out stroke of 50 mm. The angle of ascent is 120° , dwell 60°, and angle of descent 90°. The minimum radius of cam is 50 mm. Draw the profile of the cam when the axis of the follower passes through the axis of the camshaft. Also formulate the maximum velocity and acceleration during ascent and descent when the cam shaft revolves at 240 rpm. (5)

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