

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 6
Subject Code: 03113352
Subject Name: Kinematics and Dynamics of Machine

Date: 02/05/2019
Time: 10.30 am to 1.00 pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions**(15)**

- 1. A ball and a socket joint forms a**
 (a) turning pair (b) rolling pair (c) spherical pair (d) sliding pair
- 2. Which of the following is an inversion of double slider crank chain?**
 (a) Coupling rod of a locomotive
 (b) Pendulum pump
 (c) Elliptical trammels
 (d) Oscillating cylinder engine
- 3. The cam follower extensively used in air-craft engines is**
 (a) knife edge follower (b) flat faced follower (c) spherical faced follower (d) roller follower
- 4. The partial balancing means**
 (a) balancing partially the revolving masses
 (b) balancing partially the reciprocating masses
 (c) best balancing of engines
 (d) all of the above
- 5. Longitudinal vibrations are said to occur when the particles of a body moves**
 (a) perpendicular to its axis (b) parallel to its axis (c) in a circle about its axis (d) Randomly
- 6. The relation between the number of pairs (p) forming a kinematic chain and the number of links (l) is**
 (a) $l = 2p - 2$ (b) $l = 2p - 3$ (c) $l = 2p - 4$ (d) $l = 2p - 5$
- 7. The size of a cam depends upon**
 (a) base circle (b) pitch circle (c) prime circle (d) pitch curve
- 8. Natural frequency of a system is due to**
 (a) Free Vibration (b) Forced Vibration (c) Resonance (d) Damping
- 9. In a reciprocating steam engine, which of the following forms a kinematic link ?**
 (a) cylinder and piston
 (b) crank shaft and flywheel
 (c) piston rod and connecting rod
 (d) flywheel and engine frame
- 10. The ratio of the maximum displacement of the forced vibration to the deflection due to the static force, is known as**
 (a) damping factor (b) damping coefficient (c) logarithmic decrement (d) magnification factor
- 11. Define Degrees of Freedom.**
- 12. Explain the term Lower pair.**
- 13. Conditions for dynamic balancing of a shaft are _____**
- 14. When there is a reduction in amplitude over every cycle of vibration, then the body is said to have _____ Vibration.**
- 15. The component of the acceleration, parallel to the velocity of the particle, at the given instant is called _____ component.**

Q.2 Answer the following questions. (Attempt any three)**(15)**

- A) Define the terms: Mechanism, Machine, Kinematic Pair, Kinematic Chain and Inversion of Mechanism.**
- B) Explain with sketches the different types of cams and followers.**
- C) What is Balancing and why it is required? Also explain clearly the terms 'static balancing' and 'dynamic balancing'.**
- D) Explain energy method to find out natural frequency (f_n) of free longitudinal vibrations.**

Q.3 A) A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. (07)

B) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine: 1. Linear velocity and acceleration of the midpoint of the connecting rod, and 2. angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position. (08)

OR

B) Derive equation for Critical or Whirling Speed of a Shaft without considering damping. (08)

Q.4 A) What is the condition for correct steering? Sketch and show the two main types of steering gears and discuss their relative advantages. (07)

OR

A) A cam is to be designed for a knife edge follower with the following data : (07)

1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.

2. Dwell for the next 30° .

3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.

4. Dwell during the remaining 180° .

Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent, if the cam rotates at 240 r.p.m.

B) In a damped vibrating system, the mass having 20 kg makes 40 oscillations in 25 sec. The amplitude of natural vibrations decreases to one eighth of the initial value after 8 oscillations. Determine: (i) the logarithmic decrement (ii) the damping factor and damping coefficient; and (iii) spring stiffness. (08)