Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

SUMMER TERM / MAKE UP END TERM EXAMINATION

Semester: Summer Term 2019 | **Date**: 23 July 2019

Course Code: ME A 208 | **Time**: 3 Hours

Course Name: Kinematics and Dynamics of Machinery | **Max Marks**: 100

Program & Sem: BTech & IV Sem (2015 Batch) | **Weightage**: 50%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) All questions are compulsory.
(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** question carries **six** marks. (5Qx4M=20)

1. Define Machine and Mechanism.
2. Elucidate lower and higher pair.
3. Why balancing is so important?
4. State and derive law of gearing.
5. Classify toothed wheels.

Part B

Answer **all** the Questions. **Each** question carries **five** marks. (3Qx8M=24)

6. What are links? Explain the types of links.
7. Elucidate types of joints with neat sketch.
8. Derive and equation to find length of path of contact with usual notations.

Part C

Answer **All** the Questions. **Each** question carries **ten** marks. (3Qx12M=36)

9. A horizontal single cylinder reciprocating engine has a crank OC of radius 40 mm and a connecting rod PC 140 mm long as shown. The crank rotates at 3000 rev/min clockwise. For the configuration shown in Fig. 2.

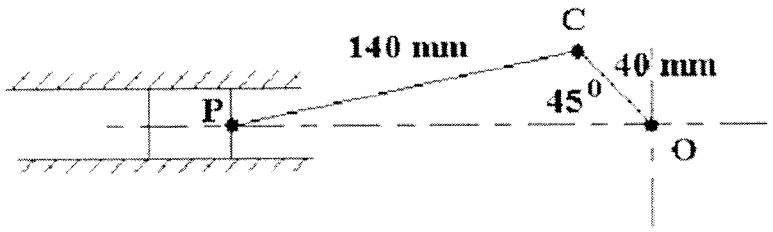

Fig. 2.

Determine the velocity and acceleration of the piston. The sliding piston has a mass of 0.5 kg and a diameter of 80 mm. The gas pressure acting on it is 1.2 MPa at the moment shown. Calculate the effective turning moment acting on the crank. Assume that the connecting rod and crank has negligible inertia and friction.

10. Two mating gears have 20 and 40 involute teeth of module 10 mm 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 the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio.

11. A rotor has the following properties.

Mass	magnitude	Radius	Angle	Axial distance from first mass
1	9 kg	100 mm	$\theta_A = 0^0$	-
2	7 kg	120 mm	$\theta_B = 60^0$	160 mm
3	8 kg	140 mm	$\theta_C = 135^0$	320 mm
4	6 kg	120 mm	$\theta_D = 270^0$	560 mm

If the shaft is balanced by two counter masses located at 100 mm radii and revolving in planes midway of planes 1 and 2, and midway of 3 and 4, determine the magnitude of the masses and their respective angular positions.

Part D

Answer **All** the Questions. **Each** question carries **one** mark. (20Qx1M=20)

12. Scotch yoke mechanism is the inversion of
    a. Single slider kinematic chain
    b. Double slider kinematic chain
    c. Four bar chain
    d. None of the above

13. One quaternary joint is equal to how many binary joints?
    a. 4
    b. 3
    c. 2
    d. none of the above

14. In a reciprocating steam engine, which of the following forms a kinematic link?
    a. cylinder and piston
    b. piston and connecting rod
    c. crankshaft and flywheel
    d. flywheel and engine frame

15. Consider the following statements:
    a. The degree of freedom for lower kinematic pairs is always equal to one.
    b. A ball-and-socket joint has 3 degrees of freedom and is a higher kinematic pair
    c. Oldham's coupling mechanism has two prismatic pairs and two revolute pairs. Which of the statements given above is/are correct?

    (a) 1, 2 and 3 (b) 1 only (c) 2 and 3 (d) 3 only

16. Which of the following are examples of forced closed kinematic pairs?
    1. Cam and roller mechanism 2. Door closing mechanism
    3. Slider-crank mechanism 4. Automotive clutch operating mechanism Select the correct answer using the codes given below:
    Codes:
    (a) 1, 2 and 4 (b) 1 and 3 (c) 2, 3 and 4 (d) 1, 2, 3 and 4

17. Consider the following pairs of parts:
    1. Pair of gear in mesh 2. Belt and pulley
    3. Cylinder and piston 4. Cam and follower. Among these, the higher pairs are
    (a) 1 and 4 (b) 2 and 4 (c) 1, 2 and 3 (d) 1, 2 and 4

18. In a Kinematic chain, a quaternary joint is equivalent to:
    (a) One binary joint (b) Two binary joints
    (c) Three binary joints (d) Four binary joints

19. When supported on three points, out of the 12 degrees of freedom the number of degrees of freedom arrested in a body is
    (a) 3 (b) 4 (c) 5 (d) 6

20. For L number of links in a mechanism, the number of possible inversions is equal to
    (a) L - 2 (b) L – 1 (c) L (d) L + 1

21. The number of inversions for a slider crank mechanism is
    (a) 6 (b) 5 (c) 4 (d) 3

22. In a single slider four-bar linkage, when the slider is fixed, it forms a mechanism of
    (a) Hand pump (b) reciprocating engine (c) quick return (d) oscillating cylinder

23. Consider the following statements:
    Cam followers are generally classified according to
    1. the nature of its motion 2. the nature of its surface in contact with the cam
    3. the speed of the cam
    Which of the statements given above are correct?
    (a) 1, 2 and 3 (b) Only 1 and 2 (c) Only 2 and 3 (d) Only 1 and 3

24. In a plate cam mechanism with reciprocating roller follower, the follower has a constant acceleration in the case of
    (a) cycloidal motion (b) simple harmonic motion
    (c) parabolic motion (d) 3-4-5 polynomial motion

25. Which one of the following sets of elements are quick acting clamping elements for fixtures?
(a) Wedge and Cam (b) Cam and Toggle
(c) Toggle and Wedge (d) Wedge, Cam and Toggle

26. A system in dynamic balance implies that
(a) the system is critically damped (b) there is no critical speed in the system
(c) the system is also statically balanced (d) there will be absolutely no wear of bearings.

27. Consider the following statements for completely balancing a single rotating mass:
Another rotating mass placed diametrically opposite in the same plane balances the unbalanced mass.
Another rotating mass placed diametrically opposite in a parallel plane balances the unbalanced mass.
Two masses placed in two different parallel planes balance the unbalanced mass.
Which of the above statements is/are correct?
(a) 1 only (b) 1 and 2 (c) 2 and 3 (d) 1 and 3

28. A system of masses rotating in different parallel planes is in dynamic balance if the resultant.
a. force is equal to zero
b. couple is equal to zero
c. force and the resultant couple are both equal to zero
d. force is numerically equal to the resultant couple, but neither of them need necessarily be zero.

29. The gears are used to connect two parallel shafts except
a. Spur gear
b. Helical gear
c. Double helical gears
d. Bevel gears

30. The gear used to convert rotary motion into translating motion is
a. Worm and wheel
b. Crown gear
c. Rack and pinion
d. Spiral Bevel gear

31. Which of the following type of gear has inclined teeth?
a. Spur gear
b. Helical gear
c. Spiral gear
d. All of the above