Roll No: | | | | | | | | | | | | | | |

# BTECH
## (SEM VI) THEORY EXAMINATION 2023-24
## THEORY OF MACHINE

**TIME: 3 HRS** **M.MARKS: 100**

**Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.

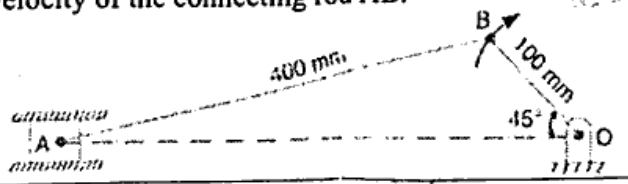
### SECTION A

**1. Attempt *all* questions in brief.** **2 x 10 = 20**

| Q no. | Question | Marks | CO |
|---|---|---|---|
| a. | What is constrained motion? Define. | 02 | 1 |
| b. | State Kennedy's theorem. | 02 | 1 |
| c. | What is the difference between radial follower & offset follower? | 02 | 2 |
| d. | State law of gearing. | 02 | 2 |
| e. | State D'Alembert's principle? | 02 | 3 |
| f. | What is coefficient of fluctuation of speed? | 02 | 3 |
| g. | What are the conditions of secondary balancing? | 02 | 4 |
| h. | What do you mean by hunting of governor? | 02 | 4 |
| i. | What is a Gyroscope? | 02 | 5 |
| j. | What is dynamometer? | 02 | 5 |

### SECTION B

**2. Attempt any *three* of the following:** **3 x 10 = 30**

| | | | |
|---|---|---|---|
| a. | Locate all the instantaneous centers of the slider crank mechanism as shown in Fig. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. Velocity of the slider A, and 2. Angular velocity of the connecting rod AB.   | 10 | 1 |
| b. | A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. | 10 | 2 |
| c. | With the help of suitable diagram, derive the expression for velocity & acceleration of the piston of reciprocating engine. | 10 | 3 |
| d. | 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. | 10 | 4 |
| e. | With the help of a neat sketch explain the working of a block or shoe brake. What is meant by a self-locking and a self-energized brake? | 10 | 5 |

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## SECTION C

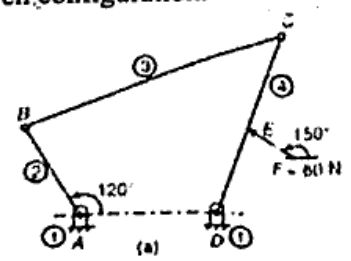
**3. Attempt any *one* part of the following:** **1 x 10 = 10**

| | | | |
|---|---|---|---|
| a. | What do you understand by inversion? Discuss any one inversion of double slider crank chain. | 10 | 1 |
| b. | Explain Coriolis component of acceleration and derive the expressions for Coriolis component of acceleration. | 10 | 1 |

**4. Attempt any *one* part of the following:** **1 x 10 = 10**

| | | | |
|---|---|---|---|
| a. | Derive the expression for minimum number of teeth required on pinion to avoid interference. | 10 | 2 |
| b. | A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below:<br>1. To raise the valve through 50 mm during 120° rotation of the cam ;<br>2. To keep the valve fully raised through next 30°;<br>3. To lower the valve during next 60°; and<br>4. To keep the valve closed during rest of the revolution i.e. 150° ;<br>The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft, The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. | 10 | 2 |

**5. Attempt any *one* part of the following:** **1 x 10 = 10**

| | | | |
|---|---|---|---|
| a. | The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 $mm^2$. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m. | 10 | 3 |
| b. | A four-link mechanism with the following dimensions is acted upon by a force 80 N at $150^0$ on the link DC as shown in fig. AD = 500 mm, AB = 400 mm, BC = 1000 mm, DC = 750 mm, DE = 350 mm Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration.<br>  <br> | 10 | 3 |

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**6. Attempt any *one* part of the following: 1 x 10 = 10**

| | | | |
|---|---|---|---|
| a. | What do you understand by effort and power of governor? Find its expression. | 10 | 4 |
| b. | The arms of a Porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve, determine how the speed range is modified. | 10 | 4 |

**7. Attempt any *one* part of the following: 1 x 10 = 10**

| | | | |
|---|---|---|---|
| a. | What is the difference between absorption and transmission dynamometer? Also explain torsion dynamometer. | 10 | 5 |
| b. | Describe the working principle of Gyroscope with the help of suitable example. | 10 | 5 |