

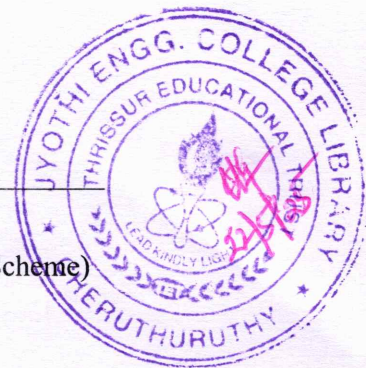
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT/WP, S3 PT) Examination May 2025 (2019 Scheme)



Course Code: MET 301

Course Name: MECHANICS OF MACHINERY

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

Marks

- | | | |
|----|---|---|
| 1 | State Grashof's criterion. Mention the conditions that a four bar mechanism should satisfy in order that it functions as (i) double crank mechanism and (ii) double rocker mechanism. | 3 |
| 2 | Sketch the mechanism used to make drawings to an enlarged or reduced scale. | 3 |
| 3 | Discuss the Coriolis's component of acceleration present in a quick return mechanism. | 3 |
| 4 | Sketch the displacement, velocity and acceleration diagrams of a cam follower having simple harmonic motion | 3 |
| 5 | What is meant by interference in gears? How can it be avoided? | 3 |
| 6 | What is meant by dimensional synthesis? | 3 |
| 7 | Explain the principle of virtual work | 3 |
| 8 | Explain the effect of gyroscopic reaction couple. on an aircraft whose engine is rotating clockwise when viewed from nose end and is turning to the left? | 3 |
| 9 | Differentiate between static and dynamic balancing. | 3 |
| 10 | Explain the reason for partial balancing in reciprocating engines? | 3 |

PART B

(Answer one full question from each module, each question carries 14 marks)

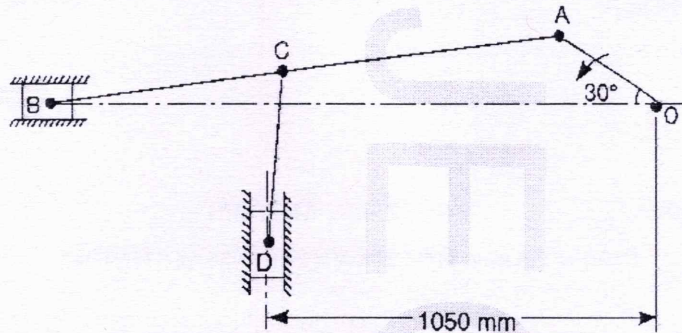
Module -1

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|----|--|----|
| 11 | a) What is meant by inversion? With the help of neat sketches explain any four inversions of the slider crank mechanism. | 14 |
| 12 | a) Explain Hart mechanism with a neat sketch. | 8 |
| | b) State and prove Kennedy's theorem | 6 |

Module -2

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|----|--|----|
| 13 | a) In the mechanism shown crank OA is 300mm long and rotates at 20rpm in counter clockwise direction. The other dimensions are AB=1200mm, BC =450mm, CD =450mm | 14 |
|----|--|----|

Determine the (i) velocity at B and D. (ii) Acceleration at D (iii) Angular acceleration of CD

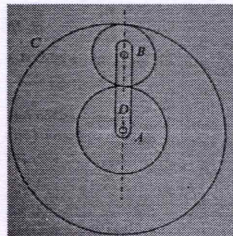


- 14 A cam rotating clockwise with a uniform speed of 300rpm gives the following motion to 14
roller follower having diameter 15mm
- i) rise through a distance of 45mm during 120° of cam rotation
 - ii) dwell for 60° of cam rotation
 - iii) follower to return to its initial position during the next 120° of cam rotation
 - iv) follower to dwell for the remaining period of 60° of cam rotation

The minimum radius of the cam is 30mm and the line of stroke of the cam is offset by 15mm to the right of the axis of the cam. The displacement of the follower is to take place with cycloidal motion for both rise and return strokes. Draw the cam profile and determine the maximum velocity and acceleration during rise.

Module -3

- 15 a) State and prove law of gearing. 9
- b) In the epicyclic gear train shown the annulus gear C is fixed and is concentric with the sun gear A. Planet gear B meshes with A and C and can rotate freely on a pin carried by arm D. Arm D rotates about an axis coaxial with A and C. If the number of teeth on A and C are T_1 and T_2 respectively show that the ratio of speeds of D to A is $T_1 / (T_1 + T_2)$. 5



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|----|------------------------------------|----|
| 16 | a) Derive Freudenstein's equation. | 10 |
| | b) Write notes on overlay method. | 4 |

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Module -4

- 17 The length of crank of a slider crank mechanism is 300 mm and of connecting rod is 1.25 m. The diameters of the journals at the slider, crankpin, and crankshaft are 80 mm, 120 mm and 140 mm respectively. The gas pressure on the piston is 450 kN/m^2 which has a diameter of 250 mm. The coefficient of friction between the slider and the guides is 0.07 and for journals it is 0.4. Solve graphically to determine the magnitude and sense of torque T applied on input link for the static equilibrium of the linkage. 14
- 18 a) A ship is propelled by 500kg mass turbine rotor running at a speed of 2100rpm. It has a radius of gyration of 0.5m and rotates in a clockwise direction when viewed from the stern. What are the gyroscopic effects under the following conditions? 14
- (i) The ship sailing at a speed of 1860m/hr steers to the left in a curve having radius 60m
- (ii) The ship pitches 6 degrees above and below the horizontal position. The bow is descending with its maximum velocity. The pitching motion is simple harmonic with a period of 20s.
- (iii) The ship rolls and has at a certain instant an angular velocity of 0.03 rad/s in clockwise direction when viewed from the stern.

Module -5

- 19 a) A rotating shaft carries four unbalanced masses 176.6N, 137.3N, 157N and 117.7N at radii 5cm, 6cm, 7cm and 6cm respectively. The second, third and fourth masses revolve in planes at a distance of 8cm, 16cm and 28cm respectively measured from the plane of the first mass and are angularly located at 60° , 135° and 270° respectively measured clockwise from the first mass. The shaft is dynamically balanced by two masses both located at 5cm radii and revolving in planes midway between those of first and second masses and midway between those of third and fourth masses. Determine the magnitude of the masses and their respective angular positions. 14
- 20 a) An engine having five cylinders in-line has successive cranks 144° apart, the distance between cylinder center lines being 450mm. Each cylinder has a reciprocating mass of 16kg. The crank radius is 135mm and length of connecting rod is 540mm. The engine runs at 600rpm. Examine the engine for balance of primary and secondary forces and couples. Also find the maximum values of these. 14
