Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **14ME2026** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MECHANICS OF MACHINES** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Determine the degrees of freedom (mobility) of the following mechanism.  i)jinf01  ii) | CO1 | 16 |
| b. | Explain Grashof criteria with examples. | CO1 | 04 |
| **(OR)** | | | | |
| 2. |  | Classify the inversions of the Double slider crank chain in detail. | CO1 | 20 |
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| 3. | a. | In the togged mechanism, as shown in the figure, the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter clockwise direction at a speed of 180 r.p.m. The dimensions of various links are as follows: OA = 180 mm, CB = 240 mm, AB = 360 mm and BD = 540 mm. For the given configuration, find:  i) The velocity of slider D,  ii) Angular velocity of links AB, CB and BD,  iii) Velocities of rubbing on the pins of diameter 30 mm at A and D, iv) Torque applied to the crank OA, for a force of 2 kN at D. | CO2 | 20 |
| **(OR)** | | | | |
| 4. | a. | A crank OB of length 300 mm rotates at 600 rpm about point O. What is the tangential velocity of point B? | CO2 | 2 |
| b. | A crank AB rotates about point A at 60 rad/sec. If the linear velocity of point B is 30 m/s, what is the crank radius? | CO2 | 2 |
| c. | Crank OA rotates in the CCW direction at 300 r.p.m. Angle COA is 60°. Determine the angular velocity of OA and tangential velocity of point A. Determine slider D velocity and the angular velocity of the link BD. The dimensions of various links are : OA = 30 mm; AB = 45 mm ; BC 50 mm ; and BD = 46 mm. The distance between the centers of rotation O and C is 60 mm. The path of travel of the slider is 10 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical. | CO2 | 16 |
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| 5. |  | Design a cam for operating the exhaust valve of an oil engine. It is required to give uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60º of cam rotation. The valve must remain in the fully open position for 20º of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam. | CO3 | 20 |
| **(OR)** | | | | |
| 6. |  | It is required to set out the profile of a cam to give the following motion with a roller follower: (i) follower to have a stroke of 20 mm during 120° of cam rotation; (ii) follower to dwell for 30° of cam rotation; (iii) follower to return to its initial position during 120° of cam rotation; (iv) follower to dwell for remaining 90° of cam rotation. The minimum radius of the cam = 25 mm. Outstroke and the return stroke of the follower are performed with uniform acceleration and uniform retardation or parabolic. | CO3 | 20 |
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| 7. | a. | Explain briefly the differences between compound and reverted gear trains. | CO4 | 4 |
| b. | An epicyclic gear consists of three gears A, B and C as shown in Fig.  The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C, and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gear B. | CO4 | 16 |
| **(OR)** | | | | |
| 8. | a. | An electric motor-driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm/min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at the screw threads is 0.1. Estimate power of the motor. | CO4 | 12 |
| b. | A 150 mm diameter valve, against which a steam pressure of 2 MN/m2 is acting, is closed by means of a square threaded screw 50 mm in external diameter with 6 mm pitch, if the coefficient of friction is 0.12, find the torque required to turn the handle. | CO5 | 08 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 meters apart and transmits 4 kW from the smaller pulley that rotates at 300 rpm. The coefficient of friction between the belt and the pulley is 0.3 and the safe working tension is 10 N per mm width.  Determine:  i) Minimum width of the belt  ii) Initial belt tension  iii) Length of the belt required. | CO6 | 14 |
| b. | Power is transmitted using a V-belt drive. The included angle of V-groove is 30º. The belt is 20 mm deep and the maximum width is 20 mm. If the mass of the belt is 0.35 kg per meter length and maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of the lap is 140º. µ = 0.15. | CO6 | 06 |