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

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**End Semester Examination – Nov/Dec – 2018**

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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. | Give an example of a mechanism and a machine. | CO1 | 1 |
| b. | State two types of joints used in mechanism. | CO1 | 1 |
| c. | Explain Kutzbach’s Criteria for planar mechanism. | CO1 | 2 |
| d. | Explain Grashof criteria with example. | CO1 | 2 |
| e. | Determine the degrees of freedom (mobility) of the following mechanism.  i)jinf01  ii) | CO1 | 14 |
| (OR) | | | | |
| 2. | a. | State an application of slider-crank mechanism. | CO1 | 1 |
| b. | Car wiper mechanism is an example of \_\_\_\_\_\_\_\_\_\_\_\_\_. | CO1 | 1 |
| c. | Explain the following joints:  i) Revolute joint, ii) Prismatic joint | CO1 | 2 |
| d. | A designer has developed a four-bar crank rocker mechanism with the following link lengths and claims one of the links is capable of making full revolution: i) Link 2 = 35 mm, ii) Link 3 = 110 mm iii) Link 4 = 70 mm and iv) Ground link 1 = 65 mm. Verify his claim using Grashoff’s Law. | CO1 | 2 |
| e. | Determine the degrees of freedom (mobility) of the following mechanism.  ii)  i) | CO1 | 14 |
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| 3. | a. | Two bodies A and B move in the same direction at 50 m/s and 40 m/s respectively. What is the relative velocity of A with respect to B. | CO1 | 1 |
| b. | Two links A and B rotate about a pin joint in opposite direction at 50 rad/s and 30 rad/s respectively. What is the relative angular velocity of A with respect to B. | CO1 | 1 |
| c. | A crank OB of length 300 mm rotates at 600 rpm about point O. What is the tangential velocity of point B? | CO1 | 2 |
| d. | 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? | CO1 | 2 |
| e. | 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 centres 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. | CO1 | 14 |
| (OR) | | | | |
| 4. | a. | Two bodies A and B move in the same direction at 60 m/s and 20 m/s respectively. What is the relative velocity of A with respect to B. | CO2 | 1 |
| b. | Two links A and B rotate about a pin joint in same direction at 50 rad/s and 30 rad/s respectively. What is the relative angular velocity of A with respect to B. | CO2 | 1 |
| c. | A crank OA of length 150 mm rotates at 300 rpm about point O. What is the tangential velocity of A. | CO2 | 2 |
| d. | A crank OB rotates about point O at 60 rad/sec. If the linear velocity of point B is 300 m/s, what is the crank radius? | CO2 | 2 |
| e. | In a slider crank mechanism, as shown in figure, the crank is 50 mm long and rotates 300 r.p.m. The length of the connecting rod is 150 mm. When the crank is at 60° from the line joining O2 and slider pin joint, determine angular velocity of crank, velocity of the slider and angular velocity of the connecting rod. (R and P represent revolute and slider joints respectively) | CO2 | 14 |
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| 5. |  | A push rod of valve of an internal combustion engine ascends and descends with uniform acceleration and uniform retardation.The base circle diameter of the cam is 50 cm, and the push rod has a roller of 16 mm, diameter to its end. The axis of the roller and the cam fall on the same vertical straight line. The maximum stroke of the follower is 2 cm. The angle of action for the outstroke and the return stroke is 60° each interposed by a dwell period of 60°. Draw the profile 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 with a diameter of 20 mm: (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. | The speed ratio of the reveted gear train as shown in fig. is to be 12. The module pitch of gear A and gear B is 3.125 mm and of gear C and D is 2.5 mm. Distance between the two shafts are 200 mm. Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth.  C:\Users\Jaysheelan1\Downloads\qp.jpg | CO4 | 18 |
| b. | State the classifications of Gear trains | CO4 | 2 |
| (OR) | | | | |
| 8. | 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 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Determine the maximum pressure in plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear. | CO5 | 5 |
| b. | A multiple disc clutch has five plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed 0.127 N/mm2, find the power transmitted at 500 rpm. The outer and inner radii of friction surfaces are 125 mm and 75 mm respectively. Assume uniform wear and take coefficient of friction = 0.3. | CO5 | 15 |