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

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

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| **Code :** | **18ME2003** | **Duration :** | **3hrs** |
| **Sub. Name :** | **THEORY OF MACHINES** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | |
| 1. | A ball and socket forms a \_\_\_\_\_\_\_\_\_\_ pair. | CO1 | 1 |
| 2. | The cam and follower is an example of \_\_\_\_\_\_\_\_\_\_ pair. | CO1 | 1 |
| 3. | The component of acceleration parallel to the velocity of the particle at a given instant is called \_\_\_\_\_\_\_\_\_\_. | CO1 | 1 |
| 4. | Velocity of a fixed link is \_\_\_\_\_\_\_\_\_\_. | CO1 | 1 |
| 5. | Contact ratio of gear always \_\_\_\_\_\_\_\_\_\_. | CO2 | 1 |
| 6. | The type of gears used to connect two non-parallel non-intersecting shafts are \_\_\_\_\_\_\_\_\_\_. | CO2 | 1 |
| 7. | The diameter of gear is usually specified by \_\_\_\_\_\_\_\_\_\_. Circle. | CO2 | 1 |
| 8. | The velocity of high velocity gear is \_\_\_\_\_\_\_\_\_\_. | CO2 | 1 |
| 9. | The ratio of the maximum fluctuation of speed to the mean speed is called \_\_\_\_\_\_\_\_\_\_. | CO3 | 1 |
| 10. | In a turning moment diagram, the variations of energy is called \_\_\_\_\_\_\_\_\_\_. | CO3 | 1 |
| 11. | \_\_\_\_\_\_\_\_\_\_ is an energy absorbing device. | CO3 | 1 |
| 12. | Due to slip of the belt, the velocity ratio of the belt \_\_\_\_\_\_\_\_\_\_. | CO3 | 1 |
| 13. | \_\_\_\_\_\_\_\_\_\_ governor is used to drive a gramophone. | CO4 | 1 |
| 14. | When the sleeve of a Porter governor moves upwards, the governor speed \_\_\_\_\_\_\_\_\_\_. | CO4 | 1 |
| 15. | A governor is said to be hunting, if the speed of the engine \_\_\_\_\_\_\_\_\_\_ continuously above and below the mean speed. | CO4 | 1 |
| 16. | The height of a Watt’s governor (in meters) in equal to \_\_\_\_\_\_\_\_\_\_. | CO4 | 1 |
| 17. | The balancing of rotating and reciprocating parts of an engine is necessary when it runs at \_\_\_\_\_\_\_\_\_\_. | CO5 | 1 |
| 18. | The primary unbalanced force is maximum when the angle of inclination of the crank with the line of stroke is \_\_\_\_\_\_\_\_\_\_. | CO5 | 1 |
| 19. | In order to facilitate the starting of locomotive in any position, the cranks of a locomotive, with two cylinders, are placed at \_\_\_\_\_\_\_\_\_\_ to each other. | CO5 | 1 |
| 20. | The swaying couple is due to the \_\_\_\_\_\_\_\_\_\_. | CO5 | 1 |

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| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | |
| 21. | Explain the inversion of mechanism used in a beam engine with neat sketch. | CO1 | 5 |
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| 22. | Classify types of kinematic pair used in mechanism. | CO1 | 5 |
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| 23. | 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. | CO2 | 5 |
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| 24. | In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B? | CO2 | 5 |
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| 25. | 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 mm2 . 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 rpm. | CO3 | 5 |
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| 26. | A pulley is driven by a flat belt, the angle of lap being 120°. The belt is 100 mm wide by 6 mm thick and density1000 kg/m3. If the coefficient of friction is 0.3 and the maximum stress in the belt is not to exceed 2 MPa, find the greatest power which the belt can transmit and the corresponding speed of the belt. | CO3 | 5 |
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| 27. | The crank and connecting rod of theoretical steam engines are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine: i) velocity of piston, ii) Angular velocity of connecting rod. | CO1 | 5 |
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| 28. | Explain the following term in details;  i) Sensitiveness of governor,  ii) Stability of governor. | CO4 | 5 |
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| 29. | Explain the working principle of governor with neat sketch. | CO4 | 5 |
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| 30. | Classify types of gears used in kinematics. | CO2 | 5 |
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| 31. | Explain the turning moment diagram of IC Engine with neat sketch. | CO5 | 5 |
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| 32. | Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. | CO5 | 5 |

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| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | |
| 33. | a. | Explain the inversion of mechanism used in quick return mechanism with a neat sketch. | CO1 | 7 |
| b. | PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm; QR = 175 mm; RS = 112.5 mm; and PS = 200 mm. The crank PQ rotates at 10 rad/clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity of links QR and RS. | CO1 | 8 |
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| 34. | a. | 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 so that the shaft shall be in complete balance. | CO5 | 6 |
| b. | The three cranks of a three cylinder locomotive are all on the same axle and are set at 120°. The pitch of the cylinders is 1 meter and the stroke of each piston is 0.6 m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for each outside cylinder and the planes of rotation of the balance masses are 0.8 m from the inside crank. If 40% of the reciprocating parts are to be balanced, find the magnitude and the position of the balancing masses required at a radius of 0.6 m; | CO5 | 9 |
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| 35. | a. | A porter governor has all four arms 250 mm long. The upper arms are attached on the axis of rotation and lower arms are attached to the sleeve at a distance of 30 mm from the axis. The mass of each ball is 5 kg and sleeve has a mass of 50 kg. The extreme radii of rotation are 150 mm and 200 mm. Determine the range of speed of the governor. | CO4 | 7 |
| b. | A shaft fitted with a flywheel rotates at 250 rpm and drives a machine. The torque of machine varies in a cyclic manner over a period of 3 revolutions. The torque rises from 750 N-m to 3000 N-m uniformly during 1/2 revolution and remains constant for the following revolution. It then falls uniformly to 750 N-m during the next 1/2 revolution and remains constant for one revolution, the cycle being repeated thereafter. Determine the power required to drive the machine and percentage fluctuation in speed, if the driving torque applied to the shaft is constant and the mass of the flywheel is 500 kg with radius of gyration of 600 mm. | CO4 | 8 |