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| B.Tech IIIYR II Semester First Mid-Term Examinations February- 2020 |
| Branch Name: MECHANICAL |
| Subject Name: DYNAMICS OF MACHINERY |
| Maximum Marks: 20 Duration: 1Hour 20 Minutes |

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| Part-A (Objective Paper) | | | |
| Answer All the following questions. (5 Multiple choice & 5 Fill in the blanks)  Marks: 10x1/2M = 5M | | Blooms Taxonomy Level | Attainment of Course Outcomes |
| 1 | The engine of an airplane rotates in a clockwise direction when seen from the tail end and the a airplane takes a turn to the left. The effect of the gyroscopic couple on the airplane will be a) to raise the nose and dip the tail b) to dip the nose and raise the tail c) to raise the nose and tail d) to dip the nose and tail | L2 | 1,2 |
| 2 | A disc spinning on its axis at 20 rad/s will undergo precession when a torque 100 N-m is applied about an axis normal to it at an angular speed if the mass moment of inertia of the disc is the 1 kg-m2 a) 2 rad/s b) 5 rad/s c) 10 rad/s d) 20 rad/s | L5 | 3 |
| 3 | A disc is spinning with an angular velocity? rad/s about the axis of spin. The couple applied to the disc causing precession will be a) 1/2Iω2 b) Iω2 c) 1/2 Iω ωp d) Iω ωp | L3 | 4 |
| 4 | The maximum fluctuation of speed is the a) the difference of the minimum fluctuation of speed and the mean speed b) differ between of the maximum and minimum speeds c) sum of the maximum and minimum speeds  d) variations of speed above and below the mean resisting torque line | L1 | 4 |
| 5 | The coefficient of fluctuation of speed is the \_\_\_\_\_\_\_\_\_\_\_\_\_ of maximum fluctuation of speed and the mean speed. a) product b) ratio c) sum d) difference | L2 | 3 |
| 6 | The engine of an airplane rotates in a clockwise direction when seen from the tail end and the airplane takes a turn to the left. The effect of gyroscopic couple on the airplane will be--------------------------------- | L4 | 2 |
| 7 | When the pitching of a ship is upward, the effect of the gyroscopic couple acting on it will be------------------------ | L4 | 3 |
| 8 | A uniform disc of diameter 300 mm and of mass 5 kg is mounted on one end of an arm of length 600 mm. The other end of the arm is free to rotate in a universal bearing. If the disc rotates about the arm with a speed of 300 r.p.m. clockwise, looking from the front, with what speed will it process about the vertical axis-------------------------------- | L5 | 4 |
| 9 | In a turning moment diagram, the variations of energy above and below the mean resisting torque line is called----------------------- | L2 | 3 |
| 10 | The ratio of the maximum fluctuation of speed to the mean speed is called ------------------------- | L1 | 2 |

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| Part-B (Descriptive Paper) | | | | |
| Answer All the following questions. Marks: 5Mx3= 15M | | | Blooms Taxonomy Level | Attainment of Course Outcomes |
| 1 | The turbine rotor of a ship has a mass of 8 tonnes & a radius of gyration of 0.6m. It rotates at 1800 rpm. clockwise, when looking from the front of the stern. Determine the Gyroscopic couple, if the ship travels at 100km/h and steers to the left in a curve of 75m radius. | L5 | | 1,2 |
|  | OR |  | |  |
|  | A four-wheeled trolley car of mass 2500kg runs on rails, which are 1.5m apart, and travels around a curve of 30m radius at 24km/h. The rails are at the same level. Each wheel of the trolley is0.75m in diameter and each of the two axles is driven by a motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of the wheels. The moment of inertia of each axle with gear and wheel is 18kg-m2. Each motor with shaft and gear pinion has a moment of inertia of 12kg-m2. The center of gravity of the car is 0.9m above the rail level. Determine the vertical force exerted by each wheel on the rails taking into consideration the centrifugal and Gyroscopic effects. State the centrifugal and gyroscopic effects on the trolley. | L5 | | 2 |
| 2 | The mass of the flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8meters, It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 120 r.p.m., find the maximum and minimum speeds. | L5 | | 3 |
|  | OR |  | |  |
|  | The turning moment diagram of a petrol engine is drawn to the following scales: Turning moment, 1mm = 5 N-m; crank angle, 1 mm = 10. The turning moment diagram repeats itself at every half revolution of the engine & the areas above & 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 the radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800rpm. | L3 | | 3 |
| 3 | Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve. | L3 | | 4 |
|  | OR |  | |  |
|  | What is the effect of gyroscopic on naval ship | L5 | | 4 |

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| Part-A (Objective Paper) | | | |
| Answer All the following questions. (5 Multiple choice & 5 Fill in the blanks)  Marks: 10x1/2M = 5M | | Blooms Taxonomy Level | Attainment of Course Outcomes |
| 1 | The rotor of a ship rotates in a clockwise direction when viewed from the stern and the ship takes a left turn. The effect of the gyroscopic couple acting on it will be a) to raise the bow and stern b) to lower the bow and stern c) to raise the bow and lower the stern d) to lower the bow and raise the stern | L2 | 2 |
| 2 | The air screw of an airplane is rotating clockwise when looking from the front. If it makes a left turn, the gyroscopic effect will a) tend to depress the nose and raise the tail b) tend to raise the nose and depress the tail c) tilt the aeroplane d) none of the mentioned | L2 | 3 |
| 3 | In a turning moment diagram, the variations of energy above and below the mean resisting torque line is called a) fluctuation of energy b) maximum fluctuation of energy c) coefficient of fluctuation of energy d) none of the mentioned | L1 | 4 |
| 4 | If E = Mean kinetic energy of the flywheel, CS = Coefficient of fluctuation of speed and Δ E = Maximum fluctuation of energy, then a) ΔE = E / CS b) ΔE = E2 × CS c) ΔE = E × CS d) ΔE = 2 E × CS | L1 | 4 |
| 5 | The ratio of the maximum fluctuation of energy to the \_\_\_\_\_\_\_\_\_\_\_ is called coefficient of fluctuation of energy. a) minimum fluctuation of energy b) work done per cycle c) coefficient of fluctuation of energy d) none of the mentioned | L1 | 3 |
| 6 | A disc is spinning with an angular velocity ω rad/s about the axis of spin. The couple applied to the disc causing precession will be----------------------- | L4 | 2 |
| 7 | A disc spinning on its axis at 20 rad/s will undergo precession when a torque 100 N-m is applied about an axis normal to it at an angular speed, if mass moment of inertia of the disc is the 1 kg-m2--------------------------- | L3 | 4 |
| 8 | The rotor of a ship rotates in clockwise direction when viewed from the stern and the ship takes a left turn. The effect of the gyroscopic couple acting on it will be ---------------------------------- | L4 | 3 |
| 9 | CS = Coefficient of fluctuation of speed, and ω= Mean angular speed = ( ω1 + ω2 )/2----------------------------- | L1 | 5 |
| 10 | The maximum fluctuation of energy is the --------------------------- | L1 | 3 |

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| Part-B (Descriptive Paper) | | | | |
| Answer All the following questions. Marks: 5Mx3= 15M | | | Blooms Taxonomy Level | Attainment of Course Outcomes |
| 1 | The heavy turbine rotor of a sea vessel rotates at 1500r.p.m. clockwise looking from the stern, its mass being 750kg. The vessel pitches with an angular velocity of 1 rad/s. Determine the gyroscopic couple transmitted to the hull when bow is rising, if the radius of gyration for the rotor is 250 mm. Also show in what direction the couple acts on the hull? | L3 | | 1,2 |
|  | OR |  | |  |
|  | A four wheeled trolley car of mass 2500kg rans on rails, which are 1.5m apart and travels around a curve of 30m radius at 24km/h. The rails are at the same level. Each wheel of the trolley is0.75m in diameter and each of the two axles is driven by motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of the wheels. The moment of inertia of each axle with gear and wheel is 18kg-m2. Each motor with shaft and gear pinion has a moment of inertia of 12kg-m2. The center of gravity of the car is 0.9m above the rail level. Determine the vertical force exerted by each wheel on the rails taking into consideration the centrifugal and Gyroscopic effects. State the centrifugal and gyroscopic effects on the trolley. | L3 | | 2 |
| 2 | The turning moment diagram of a petrol engine is drawn to the following scales: Turning moment, 1mm = 6 N-m; crank angle, 1 mm = 20. The turning moment diagram repeats itself at every half revolution of the engine & the areas above & below the mean turning moment line taken in order are 290, 680,45, 345, 965,275 mm2 . The rotating parts are equivalent to a mass of 36 kg at the radius of gyration of 155 mm. Determine the co efficient of fluctuation of speed when the engine runs at 1850 rpm. | L5 | | 3 |
|  | OR |  | |  |
|  | The flywheel of a steam engine has a radius of gyration of 1m and mass 2500kg. The starting torque of the steam engine is 1500 N-m and may be assumed constant. Determine: 1.the angular acceleration of the flywheel, and 2. The kinetic energy of the flywheel after 10 seconds from the start. | L3 | | 1 |
| 3 | Determine the maximum, minimum and average pressure in plate clutch when the axial force is 4kN. The inside radius of the contact surface is 50mm and the outside radius is 100mm. Assume uniform wear. | L5 | | 4 |
|  | OR |  | |  |
|  | Explain the effect of the gyroscopic couple on an aeroplane | L5 | | 4 |