



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023**

Semester : Semester V - 2020

Course Code : MEC4004

Course Name : Sem V - MEC4004 - Dynamics of Machines

Program : B.Tech. Mechanical Engineering

Date : 13-JAN-2023

Time : 9.30AM - 12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE FIVE QUESTIONS

5 X 2 = 10M

1. Calculate torque acting on the crank, if tangential force acting on the engine is 150 kN and 300 mm is the crank radius. (CO1) [Knowledge]
2. Define Coefficient of Fluctuation of speed in flywheel. (CO2) [Knowledge]
3. Define axis of spin. (CO3) [Knowledge]
4. What is tractive force? (CO4) [Knowledge]
5. Define rolling in ships (CO3) [Knowledge]

PART B

ANSWER ALL THE SIX QUESTIONS

6 X 10 = 60M

6. If the crank and the connecting rod are 300 mm and 3 m long respectively and the crank rotates at a constant speed of 200 r.p.m., determine: 1. The crank angle at which the maximum velocity occurs (CO1) [Comprehension]
7. Flywheel is used to store the Energy and release the Energy. Identify in which form it stores the energy and identify the relation for Fluctuation of Energy in Flywheel. (CO2) [Comprehension]

8. Boeing 747 is a globally accepted passenger aircraft. If the Aircraft is flying from Bangalore to Hyderabad and engine is rotating in clockwise direction (when seen from rear). The Aircraft Engineer wants to identify the effect of Different forces due to engine rotation while aircraft is taking a right turn. Assuming suitable parameters suggest the effect of Gyroscopic couple on the turning in aircraft.
(CO3) [Comprehension]
9. INS Sindhughosh is an attack submarine used by Indian Navy and is in service. Consider the submarine is under the rolling motion at an instance of time, suggest the effect of Gyroscopic Couple on Sindhughosh during rolling.
(CO3) [Comprehension]
10. Mr. Sukumaran is a senior vibration analysis Engineer at Mazagoan Dockyard and is encountered with a task to identify the maximum angular velocity and maximum Angular Acceleration during pitching, as a subordinate to Sukumaran identify and derive the above relations for maximum values.
(CO4) [Comprehension]
11. Giacomo Agostini is ranked 1 in two-wheeler world Riders Ranking. The rider is keen to identify the condition of no slip so he may be stable while taking a turn, As a Design Engineer suggest and elaborate each term of the relevant expression by assuming suitable data considering angle of heel and gyroscopic forces.
(CO4) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

2 X 15 = 30M

12. A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions:
- The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.
 - The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds.
 - The ship rolls and at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern. Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case
(CO3) [Application]
13. Four masses m_1 , m_2 , m_3 and m_4 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
(CO4) [Application]
