9. What is Coulomb Friction ? A beam of span 8.0 m is rested over two simple supports at two ends. The beam is carrying U.D.L. of Intensity 2.0 KN/m up to 4.0 m length from left end. A concentrated load of 5.0 kN at a distance of 6.0 m is applied on the beam. Draw S.F.D. and B.M.D. showing important values. Also find point of Contra flexure. 15

Roll No. .....

3044

B. Tech. 3rd Semester (EE) Examination – March, 2021

ENGG. MECHANICS

Paper : ESC-EE-202-G

Time : Three Hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. (a) Define truss, frame and centroid. 3

(b) Explain principle of moment. 3

(c) What is Equilibrium ? Explain conditions of Equilibrium and its types. 3

(d) Define parallel axis theorem. 3

(e) What is effect of Gyroscopic Couple on a Naval Ship during rolling ? 3

SECTION – A

2. What is tensors and its types ? Explain vectors and coordinate system. 15

3. Explain Euler's theorem for three dimensional rotation. 15

SECTION – B

4. A triangular plate in the form of an isosceles triangle ABC has the base BC = 10 cm and altitude = 12 cm. From this plate, a portion in the shape of an isosceles triangle OBC is removed. If O is the midpoint of the altitude of triangle ABC, then determine the distance of CG of the reminder section from the base. 15

5. (a) State and prove the theorem of parallel axis and perpendicular axis. 7.5

   (b) Derive an expression for the moment of inertia of a quadrant of a circular plate of radius R. 7.5

SECTION – C

6. The turbine rotor of aship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship :

   (a) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. 7.5

   (b) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees. 7.5

7. What is free body diagram ? Explain with four examples with elaborate different kinematic joints. 15

SECTION – D

8. What is Friction ? A solid shaft is to transmit 300 K W at 100 rpm if the shear stress is not to exceed 80 MPa, find the diameter of the shaft. What percentage saving in weight would be obtained if this shaft were replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, material & maximum shear stress being the same ? 15