Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEC18

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech V SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
Regulation: UG20
DYNAMICS OF MACHINERY
Time: 3 Hours **(MECHANICAL ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Write about magnitude of gyroscopic couple in an automobile.Explain the effect of the gyroscopic couple on naval ship with a neat sketch. [BL: Understand| CO: 1|Marks: 7]

   (b) The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6 m. It rotates at 1800 RPM clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steer to the left in a curve of 75 m radius.
   [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Differentiate between brake and clutch. Demonstrate the working of internal expanding brake with a neat diagram. [BL: Understand| CO: 2|Marks: 7]

   (b) A bicycle and rider of mass 100 kg are travelling at the rate of 16 km/hr on a level road. A brake is applied to the rear wheel which is 0.9 m in diameter and this is the only resistance acting. How far will the bicycle travel and how many turns will it make before it comes to rest? The pressure applied on the brake is 100 N and $\mu = 0.05$. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Describe in detail about the turning moment diagram for a multi-cylinder engine.
   [BL: Understand| CO: 3|Marks: 7]

   (b) 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 mm^2. The rotating parts are equivalent to mass of 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. [BL: Apply| CO: 3|Marks: 7]

4. (a) Outline the function of a porter governor with the help of a neat sketch.
   [BL: Understand| CO: 4|Marks: 7]

   (b) A governor of the Proell type has each arm 250 mm long. The pivots of the upper and lower arms are 25 mm from the axis. The central load acting on the sleeve has a mass of 25 kg and the each rotating ball has a mass of 3.2 kg. When the governor sleeve is in mid-position, the extension link of the lower arm is vertical and the radius of the path of rotation of the masses is

175 mm. The vertical height of the governor is 200 mm. If the governor speed is 160 RPM when in mid-position, find: length of the extension link; tension in the upper arm.

[BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Summarize about balancing of a single rotating mass by two masses rotating in different planes.

[BL: Understand| CO: 5|Marks: 7]

(b) A single cylinder reciprocating engine has speed 240 r.p.m., stroke 30 mm, mass of reciprocating parts 50 kg, mass of revolving parts at 150 mm radius 37 kg. If two third of the reciprocating parts and all the revolving parts are to be balanced, find

i) The balancemass required at a radius of 400 mm

ii) The residual unbalanced force when the crank has rotated 60° from top dead centre.

[BL: Apply| CO: 5|Marks: 7].

6. (a) Discuss about balancing of coupled locomotives. Determine the expression for swaying couple in locomotive balancing. [BL: Understand| CO: 5|Marks: 7]

(b) 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. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Elucidate the natural frequency of free longitudinal vibration by equilibrium method.

[BL: Understand| CO: 6|Marks: 7]

(b) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GN/m^2. Determine the frequency of longitudinal and transverse vibrations of the shaft. [BL: Apply| CO: 6|Marks: 7]

8. (a) What is meant by magnification factor? Explain in detail about whirling of the shaft.

[BL: Understand| CO: 6|Marks: 7]

(b) Calculate the whirling speed of a shaft 20 mm diameter and 0.6 m long carrying a mass of 1 kg at its mid-point. The density of the shaft material is 40 Mg/m^3 and Young's modulus is 200GN/m^2 .Assume the shaft to be freely supported. [BL: Apply| CO: 6|Marks: 7]

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