

**III B. Tech I Semester Supplementary Examinations, August - 2021****DYNAMICS OF MACHINERY**

(Automobile Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. Answer **ALL** the question in **Part-A**3. Answer any **FOUR** Questions from **Part-B**

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**PART -A****(14 Marks)**

1. a) Give the effect of gyroscopic couple on an aircraft when taking a left turn. [2M]
- b) Make a sketch of cone clutch. [2M]
- c) Differentiate between flywheel and governor. [2M]
- d) What are the limitations of a Watt governor? [3M]
- e) Write an expression for hammer blow in locomotive. [3M]
- f) Define Forced Vibrations. [2M]

**PART -B****(56 Marks)**

2. a) The moment of inertia of a rotating disc in aeroplane is  $15 \text{ kg-m}^2$  and the direction of rotation is clockwise when looking from front side of the aeroplane. The speed of the disc is 1600 rpm. The speed of flight is 240 km/hr. If the aeroplane makes a right turn on a curved path of 170 m radius, find the gyroscopic couple on the aeroplane and discuss the effects on it. [10M]
- b) Derive an expression for gyroscopic couple. [4M]
3. a) The mean diameter of a square threaded screw jack is 50 mm. The pitch of the thread is 10 mm. The coefficient of friction is 0.15. What force must be applied at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and to lower it? [7M]
- b) With a neat sketch explain the working of Multi plate clutch. [7M]
4. The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment  $1\text{mm}=5\text{N-m}$ ; crank angle  $1\text{mm}=1^\circ$ . 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  $\text{mm}^2$ . 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 r.p.m. [14M]



5. A Proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed of the governor. [14M]
6. The following data refers to a two- cylinder uncoupled locomotive: [14M]  
Rotating mass per cylinder=280 kg, Reciprocating mass per cylinder=300kg, Distance between wheels=1400 mm, Distance between cylinder centers=600mm, Diameter of treads of driving wheels =1800mm, Crank radius= 300mm Radius of centre of balance mass = 620mm, Locomotive speed=50Km/hr, Angle between cylinder cranks =  $90^\circ$ , Dead load on each wheel=3.5 tonne. Determine the:
- Balancing mass required in the planes of driving wheels if whole of the revolving and two-third of the reciprocating mass are to be balanced
  - Swaying couple
  - Variation in tractive force
  - Maximum and minimum pressure on the rails
  - Maximum speed of locomotive without lifting the wheels from the rails.
7. a) Governing equation of motion of an under damped single degree of freedom system with a mass of 31 kg is given as [7M]  
$$d^2x/dt^2 + (3c/7m) dx/dt + (27k/7m)x = 0.$$
  
The amplitude of damped vibration reduces from 3mm to 2mm in successive vibrations in a duration of 0.1 seconds. Evaluate:
- frequency of damped vibration,
  - logarithmic decrement
  - damping factor,
  - natural frequency,
  - stiffness and
  - damping coefficient.
- b) Write short note on following: [7M]  
i) vibration isolation; ii) Dunkerly's method.

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