III B. Tech I Semester Supplementary Examinations, October/November - 2018

DYNAMICS OF MACHINERY

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1 a) Write the effect of precession motion on the stability of moving vehicles? [4M]
b) Classify the types of dynamometers? [4M]
c) Explain the need for Dynamic force analysis [3M]
d) Write about hunting? [4M]
e) What for balancing of rotating masses are required [4M]
f) Explain the necessity of forced damped vibration [3M]

PART -B

2 a) Explain in what way the gyroscopic couple effects the motion of an aircraft while taking a turn. [6M]
b) The moment of inertia of a pair of locomotive driving wheels with the axle is 200 kg.m^2. The distance between the wheel centers is 1.6 m and the diameter of the wheel treads is 1.8 m. Due to defective ballasting, one wheel falls by 5 mm and raises again in a total time of 0.12 seconds while the locomotive travels on a level track at 100 km/h. assuming that the displacement of the wheel takes place with simple harmonic motion, determine the gyroscopic couple produced and the reaction between the wheel and rail due to this couple. [10M]

3 a) A simple band brake is operated by a lever of length 450 mm. The brake drum has a diameter of 600 mm, and the brake band embraces $5/8^{th}$ of the circumference. One end of the band is attached to the fulcrum of the lever while the other end is attached to a pin on the lever 120 mm from the fulcrum. The effort applied to the end of the lever is 2 kN, and the coefficient of friction is 0.30. Find the maximum braking torque on the drum. [10M]
b) Explain about epicyclic train dynamometer with neat diagram? [6M]

4 The turning moment requirement of a machine is represented by the equation $T = (1000+500 \sin 2\theta - 300\cos 2\theta)$ N-m. Where θ is the angle turned by the crankshaft of the machine? If the supply torque is constant, determine: [16M]
i) The moment of inertia by the flywheel. The total fluctuation of speed is not to exceed one percent of the mean speed of 300 rpm.
ii) Angular acceleration of the flywheel when the crankshaft has turned through 45^0 from the beginning of the cycle.
iii) The power required to drive the machine.
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5 The arms of a Hartnell governor are of equal length. When the sleeve is in the mid-position, the masses rotate in a circle of diameter 200mm (the arms are vertical in the mid-position). Neglecting friction, the equilibrium speed for this position is 300 rpm. Maximum variation of speed, taking friction into account, is to be $\pm$ 5% of the mid-position speed for a maximum sleeve / movement of 25 mm. The sleeve mass is 5 kg and the friction at the sleeve is 30 N.Assuming that the power of the governor is sufficient to overcome the friction by 1 % change of speed on each side of the mid-position, find (neglecting obliquity effect of arms). [16M]

i) The mass of each rotating ball
ii) The spring stiffness
iii) The initial compression of the spring

6 A single cylinder horizontal engine runs at 120 r.p.m. The length of stroke is 400 mm. The mass of the revolving parts assumed concentrated at the crank pin is 100 kg and mass of reciprocating parts is 150 kg. Determine the magnitude of the balancing mass required to be placed opposite to the crank at a radius of 150mm which is equivalent to all the revolving and 2/3 rd of the reciprocating masses. If the crank turns 300 from the inner dead centre, find the magnitude of the unbalanced force due to the balancing mass. [16M]

7 a) Derive an equation for the natural frequency of free transverse vibration of a shaft headed with a number of concentrated loads, by energy method. [7M]

b) A shaft of 10 cm diameter and 100 cm long is fixed at one end and other end carries a flywheel of mass 80 kg. Taking young's modulus for the shaft material as 2 x 10^6 kg/cm^2, find the natural frequency of longitudinal and transverse vibrations. [9M]

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