TME- 503

Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Odd Semester Examination, 2019-20
B.Tech-Mechanical Engineering (Semester- 5th)
DYNAMICS OF MACHINE

Time: 3:00 Hrs.   Max. Marks: 100

Total no. of printed pages: 2

NOTE: All questions are compulsory

Q1. Attempt any four questions: 4x5=20

a) What is a flywheel? Differentiate between the function of governor and flywheel.

b) Prove that maximum fluctuation of energy in the flywheel is $\Delta E = I\omega^2 C_S$

c) Derive the expression for moment of inertia of flywheel in term of maximum fluctuation of kinetic energy mean engine speed and maximum fluctuation of speed.

d) Write a short note on static and dynamic balancing. Also explain the need of balancing in moving engine?

e) The turning moment dig. For multicylinder engine has been drawn to a scale 1mm= 600N-m vertically & 1mm=3° horizontally. The intercepted areas between the output torque curve & then mean resistance line taken in order from one end are as +52,-124,+92,-140,+85,-72& +107 mm². When the engine is running at a speed of 600 r.p.m if the total fluctuation of speed is not exceed ±1.5% of the mean. Find the necessary mass of flywheel of radius 0.5m.

f) What are Thrust bearings and what are their types and application

Q2 Attempt any two questions: 2x10 =20

a) (i) Explain the Tractive force & swaying couple

b) (ii) Write a short note on Primary and secondary balancing.

c) Four masses m_1, m_2, m_3, m_4 are 200kg ,300kg ,240kg, and 260 kg respectively .the corresponding radii of rotation are 0.2m,0.15m,0.25m , and 0.3m .respectively and the angles between successive masses are45⁰, 75⁰,and 135⁰. Find the position and magnitude of the balance mass required,if the radius of rotation is 0.2m.

d) The following data apply to an outside cylinder uncoupled locomotive:
Mass of rotating parts per cylinder is 360 kg, Mass of reciprocating parts per cylinder is 300kg, Angle between the crank is 90°,Crank radius is 0.3m,Cylinder Center is 1.75m,Radius of balance masses is 0.75m,Wheel center is 1.45m,If the whole rotating and two-third of reciprocating parts are to be balanced in planes of the driving wheel. Find:

(i)Magnitude and angular position of balance mass.

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(ii) Speed in kilometer per hour at which the wheel will lift off the rails when the load on each driving wheel is 30 KN and diameter of tread driving wheel is 1.8m.

(iii) Swaying couple at speed arrived

2x10 =20

Q3 Attempt any two questions:

a) Derive an expression for the total frictional torque by cone clutch assuming
   i. Uniform pressure   (ii) uniform wear

b) A shaft which rotates at a constant speed of 160 r.p.m is connected by belting to a parallel shaft 720 mm apart, which has to run at 60,80,and 100 r.p.m. The smaller pulley on the driving shaft is 40 mm in radius .determine the remaining radii of the two stepped pulley for (i) a crossed belt (ii) an open belt .neglect belt thickness and slip.

c) (i) Describe the construction and operation of prony Brake dynamometer.
   (ii) Describe the principles of operation of an Internal expanding shoe brake.

2x10 =20

Q4 Attempt any two questions:

a) What is meant by the following term in governor mechanism?

   (i) Sensitiveness
   (ii) Stability
   (iii) Isochronisms
   (iv) Hunting
   (v) Equilibrium speed

b) In a spring loaded governor of Hartnell type, the mass of each ball is 1 kg, length of vertical arm of the bell crank lever is 100mm and that of horizontal arm is 50mm.the distance of fulcrum or each bell crank lever is 80mm from the axis of the rotation of the governor. The extreme radii of rotation of the balls are 75 mm & 112.5mm, the maximum equilibrium speed is 5% greater than the minimum equilibrium speed which is 360 r.p.m find the neglecting obliquity of arms, initially compression of the spring & equilibrium speed corresponding to the radii of rotation of 100mm.

c) What is meant by effort and power of a governor? Find the expression for the same in case of porter governor.

2x10 =20

Q5 Attempt any two questions:

a) Explain gyroscopic Couple and derive the expression of gyroscopic couple for a rotating disc.

b) Explain the effect of gyroscopic couple on the stability of a ship.

c) The turbine rotor of a ship has a mass of 2000kg and rotates at a speed of 3000 r.p.m .clockwise when looking from the stern side. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effect upon the ship when ship is steering to the right in a curve of 100m radius at a speed of 16.1 Knots (1 knot= 1855 m/h).Calculate also the torque and its effect when the ship is pitching in simple harmonic motion the bow falling with its max velocity .The period of pitching is 50 second and the total angular displacement between the two extreme position is 12^0. Find the maximum acceleration during pitching.