Printed Pages : 2 **Roll No.** | | | | | | | | | | | **EME603**

B.TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

THEORY OF MACHINES-II

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Attempt the following: **10 x 2 = 20**

(a) An instrument vibrates with a frequency of 1Hz when there is no damping. When damping is provided , the frequency of damped vibration was observer to be 0.9 Hz. Find the damping factor.

(b) Define – Stability, Sensitiveness, Isochronism, Hunting of governer.

(c) What do you understand by friction circle?

(d) Why are large flywheels required for shearing/punching processes?

(e) Differentiate b/w absorption & transmission dynamometer.

(f) What do you understand by open and cross belt drive?

(g) What is difference b/w gyroscopic & reaction couple?

(h) A ship has propeller of mass moment of inertia 2000 kg-m^2. It rotates at 360 rpm in clockwise sense looking from stern. Determine the gyroscopic couple & its effect when ship moves at 30 km/hr& steers to left with radius of 200m.

(i) Explain governor effort & governor power.

(j) Draw controlling force diagram for porter governor & give its equation.

SECTION – B

2. Attempt any five parts of the following questions: **5 x 10 = 50**

(a) The mass of an electric motor is 120 kg & it runs at 1500 rpm. The armature mass is 35 kg & its center gravity lies 0.5 mm from axis of rotation .The motor is mounted on five springs of negligible damping, so that the force transmitted is one-eleventh of the impressed force. Assume that the mass of the motor is equally distributed among 5 springs.

Determine 1)- stiffness of the spring 2)- the dynamic force transmitted to the base at the operating speed 3)-natural frequency of system.

(b) For proell governor with open arms:- length of arm=200mm ; distance of pivot of arms from the axis of rotation=40mm; length of extension of lower arms to which each ball is attached=100mm; mass of each ball=6 kg; mass of central load= 150 kg; if the radius of rotation of ball is 180 mm when the arm are inclined at an angle of 40^0 to the axis of rotation, find the equilibrium speed for the above configuration.

(c) How do the effects of gyroscopic couple & centrifugal force make the rider of a two-wheeler to tilt on one side? Derive the relation for the limiting speed of the vehicle. The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from left. The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple & its effect when:

(i) The ship turns right at a radius of 250 m with a speed of 25 km/h.

(ii) The ship pitches with the bow rising at an angular velocity of 0.8 rad/s.

(iii) the ship rolls at an angular velocity of 0.1 rad/s

(d) A twin cylinder uncoupled locomotive has its cylinders 0.6m apart and balance weights are 60^o apart. The plane being symmetrically placed about the Centre line.For each

cylinder the revolving masses are 300 kg at pin radius of 320 mm & reciprocating parts 285 kg. All the revolving & 2/3 of the reciprocating masses are balanced. The driving wheels are 1.8 m diameter. When the engine runs at 60 km/h , find a)-the swaying couple , b)- the variation in tractive effort & c)- hammer blow.

(e) The equation of the turning moment curve of a three crank engine is (5000+1500Sin3θ) N-m, where θ is crank angle in radians.The moment of inertia of the flywheel is 1000 kg-m^2& the mean speed is 300 rpm. Calculate 1)- power of the engine , & 2)- the maximum fluctuation of the speed of the flywheel in percentage when a)-the resisting torque is constant and b)- resisting torque is (5000+600sinθ) N-m

(f) A vehicle moving on a rough plane inclined at a speed of 36 km/h has a wheel base 1.8 m. The centre of gravity of the vehicle is 0.8 m from the rear wheel & 0.9 m above the inclined plane. Find the distance travelled by the vehicle before coming to rest & the time taken to do so when (i) The vehicle moves up the plane, &
(ii) the vehicle moves down the plane .
The brakes are applied to all.
The coefficient of friction is 0.5.

(g) Derive expression for effort & power of a porter governor. & coefficient of insensitiveness.

SECTION – C

Attempt any two parts of the following questions: 2 x 15 = 30

3. In a spring loaded governor of the hartnelltype , the mass of each ball is 5 kg & the lift of the sleeve is 50 mm. the speed at which the governor begins to float is 240 r.p.m , and at this speed the radius of the ball path is 110 mm. The mean working speed of the governor is 20 times the range of speed when friction is neglected. If the length of ball & roller arm of the bell crank lever are 120 mm & 100 mm respectively & if the distance b/w the centre of the pivot of bell crank lever & axis of governor spindle is 140 mm, determine the initial compression of the spring taking into account the obliquity of arms.If the friction is equivalent to a force of 30N at the sleeve , find the total alteration in speed before the sleeve begins to move from mid-position.

4. A horizontal steam engine running at 120 rpm has a bore of 250 mm & a stroke of 400mm. The connecting rod is 0.6 m & mass of the reciprocating part is 60 kg when the crank has turned through an angle of 45° from the inner dead centre , the steam pressure on the cover end side is 550kN/m^2& that of the crank end side is 70 kN/m^2. Consider the diameter of the piston rod equal to 50 mm. Determine, a)- turning moment on the crank shaft , b)- thrust on the bearings & c)- acceleration of the flywheel if the power of the engine is 20 kW, mass of the flywheel 60 kg & radius of gyration 0.6m

5. Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90° and 190° respectively with that of mass B in the counter clockwise direction. The rotating masses have the following properties:
m_b = 30 kg, m_c = 4o kg, m_d = 35 kg, and r_a= 150 mm, r_b = 200 mm, r_c = 100 mm and r_d = 180 mm.
Plane B and C are 250 mm apart. Determine the mass A and its angular position with that of mass B.