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EME603

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2537

Roll No. | | | | | | | | | | |

B.Tech.

(SEMESTER VI) THEORY EXAMINATION, 2012-13

THEORY OF MACHINE-II

Time : 2 Hours]

[Total Marks : 50

SECTION – A

$5 \times 2 = 10$

1. Attempt any **five** parts :

   (a) Define inertia force and inertia torque.

   (b) Define co-efficient of fluctuation and co-efficient of steadiness.

   (c) Why is the balancing of rotating parts necessary for high speed engines ?

   (d) Name the efforts caused by the unbalanced primary force acting along the line of stroke due to partial balancing of locomotives.

   (e) State the difference between effort and power of governor.

   (f) When is a governor said to be Isochronous ?

   (g) Define coefficient of sensitiveness.

   (h) What is the effect of gyroscopic couple on rolling of ship ? Why ?

   (i) Define frequency, cycle, period and free vibration.

   (j) Sketch the graph for (ω/ω_n) Vs Transmissibility for different values of damping factor.

SECTION – B

2. Attempt any **three** question parts : $3 \times 5 = 15$

   (a) Derive the expression for the Variation in tractive force.

   (b) Explain the effect of Gyroscopic couple on a Naval ship during pitching.

(c) The length and connecting rod of a horizontal reciprocating engine are 200 mm and 1m respectively. The crank is rotating at 400 rpm. When the crank has turned 30° from the inner dead centre, the difference of pressure between cover end and piston rod is 0.4 N/mm^2. If the mass of the reciprocating parts is 100 Kg and a cylinder bore is 0.4 m. Calculate

(i) Inertia force

(ii) Thrust on the side of the cylinder walls

(d) The controlling force (F_c) in Newton's and radius of rotation (r) in metres for a spring controlled governor is given by expression.

$F_c = 2800\ r - 76$

The mass of the ball is 5 kg and extreme radii of rotation of the balls are 100 mm and 175 mm. Find the maximum and minimum speeds of equilibrium. If the friction of governor mechanism is equivalent to a force of 5N at each ball, find the Co-efficient of insensitiveness of the governor at the extreme radii.

(e) The mass of an electric motor is 120 kg and it runs at 1500 rpm. The armature mass is 35 kg and 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 the five springs. Determine

(i) the stiffness of the spring

(ii) the dynamic force transmitted to the base at the operating speed.

(iii) Natural frequency of system.

SECTION – C

Attempt **all** questions : $5 \times 5 = 25$

3. Attempt any **one** part : $1 \times 5 = 5$

(a) Draw the controlling force diagram for porter governor and give its equation.

(b) State the different types of governor. What is the difference between centrifugal and inertia type governor ?

4. Attempt any **one** part : **1 × 5 = 5**

(a) The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1 mm = 325 N-m vertically and 1 mm = 3° horizontally. The areas above and below the mean torque line are -26, +378, -256, +306, -302, +244, -380, +261 and -225 mm^2 the engine is running at a mean speed of 600 rpm. The total fluctuation of speed is not to exceed ± 1.8% of the mean speed. If the radius of flywheel is 0.7 m, find the mass of the flywheel.

(b) Deduce the expression for the inertia force in the reciprocating parts, neglecting the weight of the connecting rod.

5. Attempt any **one** part : **1 × 5 = 5**

(a) A shaft is supported in bearing 1.8 m apart and projects 0.45 m beyond bearings at each end. The shaft carries three pulleys one at each end and one at the middle of its length. The mass of end pulley is 48 kg and 20 kg and their center of gravity are 15mm and 12.5 mm respectively from the shaft axis. The center pulley has a mass of 56 kg and its center of gravity is 15 mm from the shaft axis. If the pulley are arranged so as to give the static balance, determine

(i) relative angular position of the pulley

(ii) dynamic forces produced on the bearing when the shaft rotates at 300 r.p.m.

(b) A four cylinder vertical engine has cranks 300 mm long. The plane of rotation of the first, third and fourth cranks are 750 mm, 1050 mm and 1650 mm respectively from that of the second crank and their reciprocating masses are 10 kg, 400 kg and 250 kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular position of the cranks in order that the engine may be in complete primary balance.

6. Attempt any **one** part : **1 × 5 = 5**

(a) The following particulars refer to a pro-ell governor with open arms : Length of all arms = 300 mm, distance of pivot of arms from the axis of rotation = 35 mm, length of extension of lower arms to which each ball is attached = 100 mm, mass of each ball = 8 kg and mass of the central load = 60 kg. If the radius of rotation of the balls is 180 mm when the arms are inclined at an angle of 40° to the axis of rotation, find the equilibrium speed for the above configuration.

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

7. Attempt any **one** part : **1 × 5 = 5**

(a) Explain the effect of Gyroscopic couple on an Aeroplane.

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