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

PAPER ID : 140602 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VI) THEORY EXAMINATION 2013-14

THEORY OF MACHINE–II

Time : 2 Hours *Total Marks : 50*

Note :– Attempt **all** questions. All questions carry equal marks. Assume missing data and make necessary assumptions.

1. Attempt any **two** parts : **(7×2=14)**

(a) (i) What are free body diagrams of a mechanism ? How are they helpful in finding the various forces acting on the various members of the mechanism ?

(ii) What are the conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque ?

(b) The torque delivered by a two stroke engine is given by :

$T = (1000 + 300 \sin 2\theta - 500 \cos 2\theta)$Nm where θ is the angle turned by the crank from the inner dead center. The engine speed is 250 rpm. The mass of the flywheel is 400 kg and radius of gyration 400 mm. Determine (i) the power developed (ii) total fluctuation of percentage of speed (iii) angular acceleration of flywheel when the crank has rotated through an angle of 60° from the inner dead center.

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(c) A horizontal gas engine running at 200 rpm has a bore of 220 mm and a stroke of 480 mm. The connecting rod is 930 mm long and the reciprocating parts weigh 20 kg. When the crank has turned through an angle of 30° from the inner dead center, the gas pressure on the cover and the crank sides are 500 kN/m² and 50 kN/m² respectively. Diameter of the piston rod is 40 mm. Determine (i) turning moment on the crank shaft, (ii) thrust on the bearings.

2. Attempt any **two** parts : **(6×2=12)**

(a) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.

(b) A single cylinder reciprocating engine has a reciprocating mass of 60 kg. The crank rotates at 60 rpm and the stroke is 320 mm. The mass of the revolving parts at 160 rpm is 50 kg. If two-thirds of the reciprocating parts and whole of the revolving parts are to be balanced, determine the balance mass required at a radius of 340 mm.

(c) Three masses of 8 kg, 12 kg and 15 kg attached at radial distances of 80 mm, 100 mm and 60 mm respectively to a disc on a shaft are in complete balance. Determine the angular positions of the masses of 12 kg and 15 kg relative to the 8 kg mass.

3. Attempt any **two** parts : **(6×2=12)**

(a) What is function of governor ? Explain following terms : stability, isochronisms and sensitiveness.

(b) A Porter governor has equal arms 100 mm and pivoted on the axis of rotation. The mass of each ball is 4 kg and the mass on the sleeve is 20 kg. The radius of rotation of the balls is 60 mm when the sleeve begins to rise and 80 mm at maximum speed. Determine range of speed.

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(c) In a spring controlled governor, the controlling force curve is a straight line. The balls are 400 mm apart when the controlling force is 1500 N and 240 mm when it is 800 N. The mass of each ball is 10 kg. Determine the speed at which the governor runs when the balls are 300 mm apart. By how much should the initial tension be increased to make the governor isochronous ? Also, find the isochronous speed.

4. Attempt any **two** parts : **(6×2=12)**

(a) What do you mean by gyroscopic couple ? Derive the expression for its magnitude. Explain the application of gyroscopic principles to aircraft.

(b) The moment of inertia of an aeroplane screw is 20 kg m^2 and the speed of rotation is 1000 rpm clockwise when viewed from the front. The speed of the flight is 200 km per hour. Find the gyroscopic reaction of air screw on the aeroplane when it makes a left handed turn on a path of 150 m radius.

(c) In a single degree damped vibrating system, a suspended mass of 8 kg makes 30 oscillations in 18 s. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the (i) stiffness of the spring, (ii) logarithmic decrement, (iii) damping factor and (iv) damping coefficient.