Printed Pages : 7

EME603

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

PAPER ID : 140602

Roll No.

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

THEORY OF MACHINE - II

Time : 2 Hours] [Total Marks : 50

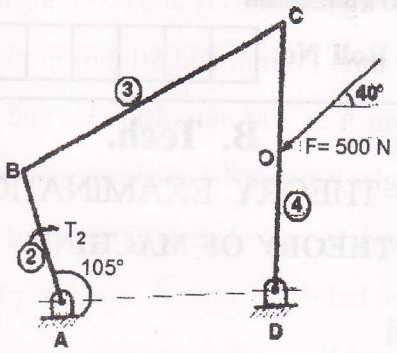
Note : Attempt all questions.

1 Attempt any two parts : 2×5=10

(a) Consider a single cylinder Horizontal engine. Derive the expression for net force acting on the piston. Resultant load on the gudgeon pin and thrust on the cylinder walls and crank effort.

(b) The four bar chain mechanism in which crank is driven by an input torque T_2 in clockwise direction and roker link is subjected to external force F = 500 N at mid point. Find all the constraint forces for static equilibrium of the

mechanism. Link length are AB = 30 cm, BC = 70 cm, CD = 60 cm, AD = 50 cm, OD = 30 cm.



(c) The turning moment diagram of a quadruple expansion marine engine (multi cylinder engine) drawn to the following scale : 1 cm = 15 ton-m and 1 mc = 15°. The areas of the loops above and below the mean turning moment line taken in order are 0.12, 0.34, 0.91, 0.81, 0.15, 0.18, 1.86, 1.71 cm^2. If the moment of inertia of the propeller and entrained water is 100 ton-m^2 and the mean speed of rotation is 100 rpm, determine the value of coefficient of fluctuation of speed.

2 Attempt any two part : **2×5=10**

(a) A shaft carries four masses A, B, C and D of magnitude 200 kg , 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.

(b) The three cranks of a three cylinder locomotive are all on the same axle and are set at 120°. The pitch of the cylinders is 1 meter and the stroke of each piston is 0.6 m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for each outside cylinder and the planes of rotation of the balance masses are 0.8 m from

the inside crank. If 40% of the reciprocating parts are to be balanced, find : (i) the magnitude and the position of the balancing masses required at a radius of 0.6 m; and 2. The hammer blow per wheel when the axle makes 6 r.p.s.

(c) Derive the following expressions, for an uncoupled two cylinder locomotive engine :

(i) Variation of tractive effort

(ii) Swaying couple

(iii) Hammer blow.

3 Attempt any two part : **2×5=10**

(a) The upper arms of a Porter governor have lengths 350 mm and are pivoted on the axis of rotation. The lower arms have lengths 300 mm and are attached to the sleeve at a distance of 40 mm from the axis. Each ball has a mass of 4 kg and mass on the sleeve is 45 kg. Determine the equilibrium speed for a radius of rotation of 200 mm and find also the effort and power of the governor for 1 per cent speed change.

(b) Discuss and derive the effort and power for porter governor.

(c) Describe Hartnell type governor with the help of neat sketch. Derive expression for equilibrium speed.

4 Attempt any one part : **1×10=10**

(a) The engine and the propeller of an aero plane weights 5 kN and the radius of gyration is 50 cm. The propeller rotates at 3000 rpm in clockwise direction looking from rear. If the aero plane makes quarter of a circle turn of radius 100 m towards left hand side while flying at 240 km/hr, what gyroscopic couple will act on the aero plane frame and what will be its effect ?

(b) A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in resonant amplitude of 12.5 mm with a period of 0.2 second. If the system is excited by a

harmonic force of frequency 4 Hz, what will be the percentage increase in the amplitude of vibration when damper is removed as compared with that with damping.

5 Attempt any one part. **1×10=10**

(a) How do the effects of gyroscopic couple and centrifugal force make the rider of two-wheeler to tilt on one side ? Derive the relation for the limiting speed of the vehicle.

(b) Explain the gyroscopic effect on naval ship. The turbine rotor of a ship has a mass of 3500 kg and rotates at a speed 2000 rpm. The rotor has a radius of gyration of 0.5 m and rotates in clockwise direction when viewed from the stern. Determine the magnitude of gyroscopic couple and its direction for the following conditions.

(i) When the ship runs at a speed of 12 knots (1 knot = 1.8 kmph) and steers to the left in a curve of 70 m radius.

(ii) When the strip pitches 6 above and 6 below the horizontal position and bow end is lowered. The pitching motion is simple harmonic with periodic time 30 sec.

(iii) When the strip rolls and at a certain instant, it has an angular velocity 0.05 rad/sec clockwise viewed from the stern.
