INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B.Tech. (Marine Engineering) Third Semester
(AY 2009-2014 batches)

Mechanicas of Machines - I (UG11T1305/ UG11T2305)

Date : 06.07.2017 Maximum Marks: 100
Time: 3 Hrs Pass Marks : 50

PART – A 10 X 3 = 30 Marks

1.
(a) How are the cams classified? Describe in short.

(b) Compare any three aspects of Cycloidal and Involute Tooth Forms.

(c) What do you mean by dynamical equivalent system? Explain.

(d) In what way can the angular velocity be represented by a vector?

(e) Draw the turning moment diagram for a Multi-cylinder Engine.

(f) What is the Coriolis acceleration component? In which cases does it occur?

(g) What is meant by effort and power of a governor?

(h) Explain Equivalent offset inertia force.

(i) State the law of gearing.

(j) Define the terms coefficient of fluctuation of energy and coefficient of fluctuation of speed.

PART – B

5 X 14 =70 Marks

(Answer any 5 of the following)

2. In the toggle mechanism shown in Fig.1 the crank OA rotates at 210 rpm counter clockwise increasing at the rate of 60 rad/s². For the given configuration determine:

a) Velocity of slider D and angular velocity of link BD (7 Marks)

b) Acceleration of slider D and angular acceleration of link BD (7 Marks)

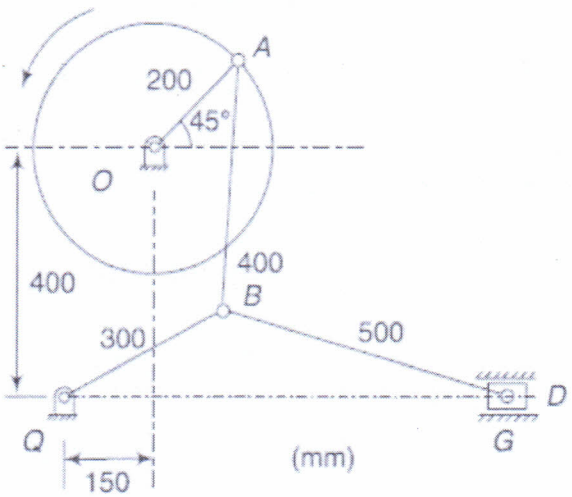

Fig.1

3. Draw the cam profile for following conditions:

Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with SHM, for 60° cam rotation; dwell for 45° cam rotation; return stroke with SHM, for 90° cam rotation; dwell for the remaining period. Determine maximum velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction. (14 Marks)

4. a) Two gear wheels 10 cm and 15 cm pitch diameters have involute teeth of 1.6 diametral pitch and pressure angle of 20°. The addenda are 3 mm. Determine:

1. Length of path of contact (3 Marks)
2. Contact ratio and (3 Marks)
3. The angle turned through by the pinion while any one pair of teeth is in contact. (3Marks)

b) Two spiral gears have a normal module of 12 mm and the angle between the shaft axes is 60°. The driver has 16 teeth and a helix angle of 25°. If the velocity ratio is ½ and the driver and the follower both are left handed, find the centre distance between the shafts. (5 Marks)

5. The connecting rod of a vertical reciprocating engine is 2.5 m long between centres and has a mass of 400 kg. Its centre is 1 m from big end bearing, when suspended from cross head pin and allowed to swing, the period of oscillation is 2.93 sec. the crank is 0.5 m long and rotates at 240 rpm, when the crank has turned through 45° from top dead centre, find due to inertia of connecting rod

(a) The magnitude and the line of the resultant force acting upon the connecting rod (6 Marks)
(b) The reaction at the cross head guide (3 Marks)
(c) The force on the main bearing and (3 Marks)
(d) The torque on the crank shaft. (2 Marks)

6. The heavy rotating masses, ie. The turbine rotor of a sea vessel rotates at 1500 rpm, clockwise looking from stern, its mass being 750 kg. The vessel pitches with an angular velocity of 1 rad/sec. Determine the gyroscopic couple transmitted to the hull when the bow is rising, if the radius of gyration of the rotor is 25 cm. The rotating mass of the rotor is supported on bearings 2.5 m apart. Determine the maximum reaction at the bearings and the direction of reaction forces. The centre of gravity may be assumed at mid-span of bearings. (14 Marks)

7. A loaded governor of the Porter type has equal links 25 cm long pivoted at the axis. The weight of each ball is 29.4 N and the weight of the central load is 137.34 N. The ball radius is 15 cm when the governor begins to lift and 20 cm at the maximum speed. Determine the maximum and minimum speeds and the range of speed.

If the friction at the sleeve is equivalent to 14.7 N, find the maximum and the minimum speeds and the range of speed. (14 Marks)

8. The turning moment for an engine consists of a curve represented by the equation

$T = (19614 + 9316.7 \sin 2\theta - 5590 \cos 2\theta)$ Nm

Where θ is the angle moved by the crank from inner dead centre. If the resisting torque is constant, determine:

(a) Power developed by the engine (5 Marks)

(b) Moment of inertia of flywheel in kg-m2, if the total fluctuation of speed is not to exceed one per cent of mean speed which is 180 rpm and (5 Marks)
(c) Angular acceleration of the flywheel when the crank has turned through 45° from the inner dead centre (4 Marks)

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