INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATIONS December 2017
B Tech (Marine Engineering)
Third Semester
Mechanics of Machines – I
UG11T2305/1305

Date: 14.12.2017 Maximum Marks: 100
Time: 3 hours Pass Marks: 50

PART –A Marks: 10X3 = 30 Marks

(All questions are compulsory)

1 (a) What is kinematic analysis of Complex Mechanism?

(b)What is In –Line cams and off center Cams?

(c) What is Flywheel .What role is there for it, in Engine used in Ship ?

(d)Sketch any one Turning moment diagrams of Reciprocating engines.

(e)Explain the types of Cams and followers?

(f) What is Ferguson's Paradox with respects to gear trains?

(g)Explain Epicyclic gear Train with sketch?

(h) What is meant by conjugate gears? Explain

(i) explain what is (i) Addendum (ii) Circular pitch (iii) Pressure Angle

(j) Explain briefly gyroscopic stabilization particularly of the Sea Vessels?

PART- B Marks: 5X14 = 70 Marks

(Answer any five of the following seven questions)

(2) (a)(Explain in detail about the Fluctuation of Energy and Fluctuation of speed in Flywheels with diagrams .

(7 Marks)

(b)Explain in detail about Co- efficient of fluctuation of energy and Co- efficient of fluctuation of speed.

(7 Marks)

(3) The turning moment of an engine is given by the equation: 2500 +750 Sin $3P$ N-m where $\boldsymbol{\theta}$ is the crank angle in radians. The mean speed of the engine 300 rpm. The flywheel along with other rotating parts attached to the engine have a mass of 500 kg at a radius of gyration or 0.8 m. Determine (i) the power developed by the engine and (ii) the percentage fluctuation of speed of flywheel for
(a) The resisting Torque to remain constant
(b) The resisting torque to vary as: (2500 +30 sin$\boldsymbol{\theta}$) N-m .

(14 Marks)

(4) A cam has straight working surfaces which are tangential to the base circle of the cam. The follower is a roller follower with line of stroke passing through the axis of the cam. The particulars are the following

Base circle Diameter: 90 mm
Roller diameter: 40 mm
The angle between the tangential faces of cam = 90°
The faces are joined by a nose circle of radius = 5 mm
R.p.m. of the Cam = 120
Determine the acceleration of the roller centre (i) when the roller just leaves contact of the flank on its ascent, (ii) When the roller is at its outer end of its lift .

(14 Marks)

(5) It is required to set out the profile of a cam to give the following motion to the oscillating roller follower
(a)follower to move outwards by an angular displacement of 30° during 120° of cam rotation .
(b) follower to dwell for 30° of cam rotation at the end of out stroke
(c) follower to return to the initial position during the 120° of cam rotation
(d) follower to dwell during the next 90° of cam rotation .
The distance between oscillating follower point centre and the cam axis =115 mm. The distance between pivot and oscillating roller follower centre or the length of the follower = 100 mm , minimum radius of the cam =50mm : and the follower roller radius =10mm
(e) Speed of the cam = 500 rpm in clock wise direction
The out stroke and return stroke is executed with simple harmonic motion .

(14 Marks)

(6) The mass of turbine rotor of a ship is 3500 kg. It has a radius of gyration of 0.45 cm and a speed of 3000 r.p.m clockwise when looking from the stern. Estimate the gyroscopic couple and its effects upon the Ship under the following two conditions.

(a) When the ship is steering to the left in a curve of 100 m radius at a speed of 36 KM /hour .

(b) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.

(14 Marks)

(7) Two gear wheels mesh externally and are to give a velocity ratio of 3. The teeth are of involute form. Module pitch is 2.5 mm: addendum = module; pressure angle is 18°. The pinion rotates at 90 r.p.m.
Determine
(i) The number of teeth in each in each wheel; so that interference is just avoided;
(ii)The length of path and arc of contact ;
(iii)The number of pairs of teeth in contact; and
(iv)The maximum velocity of sliding between the teeth.

(14 Marks)

(8) A four wheeled trolley of total weight 20 KN running on rails of 1 meter gauge rounds a curve of 30 meters at 40 km/hour on a track of embankment slope of 10 degree. The wheels have external diameter of 60 cm and each pair of axle weighs 200 N and has a radius of gyration of 25 cm . The height of the centre of gravity of the car above the wheel base is 1 meter . Determine . allowing for centrifugal force and gyroscopic couple acting the pressure on each rail .

(14 Marks)
