INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examinations- June-July 2019

Semester – III

B.Tech (Marine Engineering)

Mechanics of Machines -I (UG11T1305 / UG11T2305)

Date: 18-07-2019	Maximum Marks: 100
Time: 3 Hrs	Pass Marks: 50

PART – A

(10 X 3 = 30 Marks)

Answer ALL Questions

1. (a) Explain the term Kinematic Link. Give the classification of Kinematic link.

   (b) Why Flywheel is required in Diesel Engines?

   (c) Explain the types of Cams and Followers.

   (d) Draw a suitable sketch of Cam and Explain Base Circle, Flank, Addendum & Dwell.

   (e) What do you understand the term 'Gear Train'? Explain.

   (f) What is meant by Conjugate Gears? Explain.

   (g) Define- Law of Gearing

   (h) What is the effect of Gyroscopic couple on a naval ship during pitching?

   (i) Define-Effort and Power of a Governor.

   (j) Draw the Turning Moment diagram of a Multi Cylinder Engine.

PART – B

(5X14 =70 Marks)

Answer any FIVE questions from the following

a) Draw a suitable sketch and find with respect to Piston Effort the

2. relation of Crank effort, Force acting on Connecting rod, side thrust on Cylinder wall and Turning moment on the Crank shaft. (7)

b) In a slider Crank Mechanism, the length of the crank and connecting rod are 300mm and 800 mm respectively. The crank position is 600 from inner dead centre. The crank shaft speed is 650 rpm (clockwise). Using an analytical method determine (i) velocity and acceleration of slider (ii) Angular velocity of connecting rod. (7)

3. a) Draw turning moment diagram of a Marine Propulsion Engine and explain reason for using flywheel. (7)

b) In a four bar mechanism ABCD, AD is fixed which is 400 mm long. The crank AB is 150 mm long and rotates at 140 rpm clockwise, the link CD of 300 mm long oscillates about D. BC and AD are equal length and angle BAD = 600, find the angular velocity of link CD. (7)

4. Draw a profile of a Radial Cam operating with knife edge follower having lift of 50mm. The out stroke of follower is S.H.M. for 160^0 cam rotation followed by a dwell of 60^0. The follower returns with also S.H.M, for next 120^0 rotation of cam, again followed by dwell period. The cam rotates at 140 rpm and base circle diameter is 60mm. Find also maximum velocity and acceleration of follower both in out stroke and return stroke. [14]

5. a)
Derive the relation of gyroscopic couple, angular momentum, precession angular velocity of a suspended spinning flywheel. Also draw the vector diagram of above three vectors. (6)

b) The mass of a Turbine rotor of a ship is 40 tonne and has radius of gyration of 750mm. The turbine rotates at 5000 rpm in clock wise direction looking from aft. The ship pitches through 7^0 above and 7^0 below the horizontal position, the motion being S.H.M. having time period 20 sec. Determine (i) Maximum gyroscopic Couple, (ii) maximum angular acceleration of pitching, (iii) the direction in which the bow will tend to turn while rising by showing proper vector diagram. (8)

6. The speed ratio of a pair of Spur Gear is 4:1. The teeth are in Volute profile, module is 5 mm. Addendum is one module, pressure angle is 20^0. The Pinion rotates at 140 rpm. Determine i) No. of teeth of Pinion and Gear to avoid interface ii) The length of path of contact and arc of contact iii) contact ratio iv) maximum sliding velocity. (14)

7. Construct the profile of a CAM to suit the following specifications. Camshaft diameter = 45 mm, Least radius of cam 25 mm. Diameter of roller=28 mm, Angle of lift= 120°, angle of fall = 150°, lift of the follower = 45 mm, number of pauses are two of equal interval between motions. (14)

8. In an epicycle gear train, the internal wheels A & B are compound wheels C and D rotate independently about axis "O". The wheels E & F rotate on pins fixed to the arm G. E gears with A and C, F gears with B and D. All the wheels have the same module and the number of teeth are T_C=28, T_D= 26, T_E= T_F = 20
a) Sketch the arrangement
b) Find the numbers of the teeth on A & B
c) If the arm G makes 100 rpm clockwise and A is fixed. Find the speed of B
d) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counter clockwise. Find the speed of wheel B. (14)