

**INDIAN MARITIME UNIVERSITY**  
**(A Central University, Govt. of India)**

B.Tech (Marine Engineering) - Semester - III  
December 2015 End Semester Examinations

**Mechanics of Machine - I**

Subject Code: UG11T2305/ UG11T1305

Time: 3 hrs

Max Marks: 100

Date: 22.12.2015

Pass Marks: 50

**Part- A**

(10 x 3 Marks= 30 Marks)

**Compulsory Questions**

1.
  - a) Define coefficient of fluctuation of speed and energy of flywheel.
  - b) Explain Kinematics and dynamics of machine.
  - c) Explain rubbing velocity at pin joint.
  - d) Explain with sketch different type of follower and type of constraint of follower with cam.
  - e) Draw suitable sketches of cam with roller type follower and explain base circle, pressure angle and pitch circle.
  - f) Draw a suitable sketch and express the relation between base circle, pitch circle and pressure angle of a involute profile tooth of a pair of gears.
  - g) Draw a suitable sketch and explain laws of gearing.
  - h) Explain circular pitch, diametral pitch, module, addendum and dedendum of a gear.
  - i) Explain epicyclic gear train, how it differs with general gear train.
  - j) A top (toy) spinning anticlockwise from top and making  $30^\circ$  with vertical. Draw relevant mutually perpendicular three vectors in plan and elevation view.

**Part - B**

(5 X 14 Marks= 70 Marks)

**Answer any five of the following**

2.
  - a) In a four bar mechanism ABCD, AD is fixed which is 300 mm long. The crank AB is 100 mm long and rotates at 120 r.p.m. clockwise, the link CD of 200 mm long oscillates about D. BC and AD are equal length and angle  $BAD = 60^\circ$ , find the angular velocity of link CD.
  - b) In a slider Crank Mechanism, the length of the crank and connecting rod are 200mm and 700 mm respectively. The crank position is  $60^\circ$  from inner dead centre. The crank shaft speed is 600 rpm (clockwise). Using an analytical method determine  
(i) velocity and acceleration of slider (ii) Angular velocity of Connecting rod.  
[7+7]
3.
  - a) Draw turning moment diagram of a petrol engine and explain reason for using fly wheel.
  - b) Draw a suitable sketch and find with respect to piston effort the relation of crank effort, force acting on connecting rod, side thrust on cylinder wall and turning moment on the crank shaft.  
[7+7]

4. Draw a profile of a radial cam operating with knife edge follower having lift of 40mm. The out stroke of follower is S.H.M. for  $150^\circ$  cam rotation followed by a dwell of  $50^\circ$ . The follower returns with also S.H.M, for next  $120^\circ$  rotation of cam, again followed by dwell period. The cam rotates at 120 rpm and base circle diameter is 50mm. Find also maximum velocity and acceleration of follower both in out stroke and return stroke. [14]
5. Two involute gears of  $20^\circ$  pressure angle are in mesh. The number of teeth of pinion is 20 and gear ratio is 2. If module is 5 mm and pitch line speed is 1.2 m/sec, addendum is one module find (i) The angle turned through pini [14]
6. a) Draw a cross sectional view of two meshing helical gear having angle of helix is  $\beta$ . Explain left hand and right hand gear. Build up a relation of axial pitch, circular pitch, normal pitch, lead and lead angle.
- b) i) Explain difference between spiral gear and helical gear,  
 ii) Two left handed spiral gear connect two shaft at  $60^\circ$  apart. The normal module is 6mm. the larger gear has 70 teeth and velocity ratio is 0.5. If the helix angle of larger gear is  $34^\circ$ , find centre distance of two gears. [7+7]
7. a) Draw and explain different type of general gear train and show the relation between speed and number of teeth of input gear and output gear.
- b) Draw a suitable sketch of worm and worm wheel and explain its operation, and find speed ration between input and output. [7+7]
8. 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.
- b) The mass of a turbine rotor of a ship is 30 tonne and has radius of gyration of 700mm. The turbine rotate at 3000 rpm in clock wise direction looking from aft. The ship pitches through  $7^\circ$  above and  $7^\circ$  below the horizontal position, the motion being S.H.M. having time period 15 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. [6+8]

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