

INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Third Semester – Mechanics of Machines- I (UG11T1305/UG11T2305)

Date : 28.06.2016
Time: 3 Hrs

Max. Marks: 100
Pass Marks: 50

Part - A
Answer all the Questions

(3 x10 = 30 Marks)

1. a) Define coefficient of fluctuation of speed and coefficient of fluctuation of steadiness
- b) Define rubbing velocity.
- c) State law of gearing.
- d) Define module of gears and its relation to circular pitch.
- e) Define the terms velocity ratio and sliding ratio.
- f) How epicyclic gear trains differs from other types of gear trains.
- g) Explain Coriolis Component of acceleration
- h) Define coefficient of fluctuation of energy in flywheel
- i) Draw sketch of cam with follower based on type of movement of follower.
- j) Explain with sketch conical precession angular velocity with respect to gyroscope

Part - B
Answer Any Five of the following

(5 x 14 = 70 Marks)

- 2) (a) In a four bar mechanism ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of the link CD, when angle BAD = 60°.
- (b) In a slider crank mechanism, the length of the crank and the connecting rod are 150 mm and 600 mm respectively. The crank position is 60° the inner dead center. The crank shaft speed is 450 rpm (clockwise). Using analytical method, determine:
 - (i) Velocity and acceleration of the slider,
 - (ii) Angular velocity and angular acceleration of the connecting rod.

(7+7 Marks)
- 3) (a) Define the following terms with respect to gears:
 - (i) Pitch circle, (ii) Pressure angle, (iii) Backlash, (iv) Clearance
- (b) The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20° involute profile and module is 6 mm. if the arc of contact is 1.75 times the circular pitch, find the addendum.

(8 +6 Marks)
- 4) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form: module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 rpm. Determine: 1. The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel. 2. The length of path and arc of contact, 3. The number of pairs in contact, 4. The maximum velocity of sliding.

(14 Marks)

- 5) a) Draw a force vector diagram of piston, connecting rod and crank of an engine where crank radius "r" makes an angle " θ " with inner dead centre and 'l' is length of connecting rod. Express (i) crank effort, (ii) force on connecting rod and (iii) Side thrust on cylinder by piston in terms of piston effort, " θ " and n where $n=l/r$. (7 Marks)
- b) If mass of reciprocating parts of an engine is 300kg, $r=250\text{mm}$, $l=1.2\text{m}$, $\theta=60^\circ$, net pressure exerted on piston is 0.4 N/mm^2 , diameter of the engine cylinder is 0.5m and engine runs at 300rpm, find (i) crank effort, (ii) thrust on connecting rod, (iii) side thrust on cylinder (iv) turning moment on crank shaft. (7 Marks)
- 6) In an epicyclic gear train an arm 'C' carries two gears 'A' and 'B' having number of teeth T_a and T_b respectively. If arm 'C' rotates 1 revolution clockwise, how many times gear 'B' will rotate where gear 'A' is fixed. Derive the relation by Tabular method and relative velocity method if $T_a = 200$, $T_b=25$. Find the revolution of 'B'. (14 Marks)
- 7) a) Referring Suspended Flywheel derive with proper sketch the relation of gyroscopic couple, with angular momentum of spinning fly wheel, and processing angular velocity. Draw all the mutually perpendicular vectors. (6 Marks)
- b) A turbine rotor on a ship has a mass of 25 tonne and radius of gyration of 500 mm and rotates at 2500 rpm in anticlockwise direction looking from aft. The ship pitches through an angle 6° above and 6° below the horizontal position, the motion being simple harmonic motion and having a time period 12 seconds. Determine maximum gyroscopic couple on the holding down bolts of turbine. Analyse with vector diagram the direction of bow will tend to turn while rising. (8 Marks)
- 8) A cam has straight working surface which are tangential to the base circle of the cam. The line of stroke of roller type follower passes through the axis of cam. The angle between tangential face of the cam is 90° and faces are joined by nose circle radius of 5mm. The speed of rotation of the cam is 130 rpm, the roller diameter is 40 mm. The base circle diameter is 90 mm. Find the displacement velocity and acceleration of roller centre when,
- (a) roller is just about to leave the straight flank.
 (b) when the roller is outer end of its lift (14 Marks)
