

INDIAN MARITIME UNIVERSITY
(A CENTRAL UNIVERSITY, GOVT. OF INDIA)
End Semester Examination December 2018
B. Tech. (Marine Engineering)
Semester - III
Mechanics of Machines -I (UG11T2305)

Date: 07-01-2019
Time: 3 Hrs.

Max Marks: 100
Pass Marks: 50

Part-A

Marks: 10 x 3 = 30

(All Questions are compulsory)

Q1.

- a) Define fluctuation of energy, coefficient of fluctuation of speed and coefficient of fluctuation of energy for a flywheel
- b) Draw a well labeled displacement diagram of a follower undergoing uniform velocity motion
- c) Define simple gear train, compound gear train and reverted gear train.
- d) Mention all positions in an outstroke of a roller follower with tangent cam where the velocity of follower is maximum and where the velocity of follower is minimum.
- e) Name and draw simple sketch of any three types of followers.
- f) Define circular pitch, diametral pitch and module pitch
- g) Define pitch circle, addendum circle and dedendum circle
- h) Explain gyroscopic effect on ship when its bow is rising up
- i) Draw a neat sketch showing axis of spin, axis of precession and axis of gyroscopic couple for a rotating disc.
- j) What is the condition for maximum efficiency of spiral drive with respect to its spiral angle? Determine spiral angles of a right angle spiral drive having a friction angle of 6 degrees in order to have maximum efficiency.

PART B**Marks: 5 x 14 = 70****(Answer any 5 of the following 7 questions)**

2. The turning moment diagram of a multicylinder engine is drawn to the scale of 1 cm = 5000 Nm and 1 cm = 60 degrees respectively. The intercepted areas between output torque curve and mean resistance line taken in order from one end are -0.3, +4.1, -2.8, +3.2, -3.3, +2.5, -3.6, +2.8, -2.6 cm² when the engine is running at 800 rpm. The engine has a stroke of 30 cm and the fluctuation of speed is not to exceed 2% of mean speed. Determine suitable diameter and cross section of the flywheel rim for the limiting value of shaft centrifugal stress of $280 \times 10^5 \text{ N/m}^2$. The material density of shaft is 7.2 g/cm^3 . Assume thickness of the rim to be $1/4^{\text{th}}$ of the width. [14]
3. A pinion with 20 teeth is in mesh with a gear with 60 teeth. The pressure angle is 20 degrees and addendum of 7 mm. Addendum = 1 module. Determine (a) path of approach (b) path of recess (c) path of contact (d) arc of contact (e) contact ratio (f) velocity of sliding at pitch point. [14]
4. In a spiral gear drive, the spiral angle of teeth on the driving wheel has been fixed at 50 degrees. The normal pitch of the teeth is 12 mm. The driving wheel A, turns at twice the speed of driven wheel B. The shafts are at right angle and the approximate center distance between them is 175 mm. Determine the dimensions for suitable gears for the drive, giving for each wheel (a) number of teeth (b) spiral angle (c) circular pitch (d) pitch diameter (e) exact centre distance (f) efficiency of the drive if coefficient of friction is 0.1 and (g) maximum efficiency of the drive [14]
5. The ratio of connecting rod length to crank length of a vertical gasoline engine is 4. The engine bore and stroke is 8 cm and 10 cm respectively. The mass of reciprocating part is 1 kg. The gas pressure on the piston is 6 bars, when it has moved 40 degrees from the inner dead center on its power stroke. The engine runs at 2000 r.p.m. Determine (a) net load on piston (b) net load on gudgeon pin (c) net load on crank pin (d) thrust on cylinder walls (e) thrust on crank bearings. [14]

6. Draw a cam profile that gives the following motion to a knife edge follower. Follower has a 20 mm stroke during 120 degrees of outstroke. Follower to dwell for next 30 degrees. Follower returns to its original position during next 120 degrees of cam rotation. Follower to dwell for remaining 90 degrees. The minimum radius of the cam is 25 mm. Outstroke and return stroke of follower are performed with simple harmonic motion. [14]
7. A flat ended valve tappet is operated by a symmetrical convex cam. The straight line path of tappet passes through the cam axis. Total angle of action is 150 degrees. Maximum lift is 6 mm. Base circle diameter is 30 mm. Period of acceleration is half the period of retardation. The cam rotates at 1250 r.p.m. Determine (a) nose radius (b) flank radius (c) maximum acceleration during lift (d) maximum retardation during lift. [14]
- 8.
- a. A flywheel of mass 10 kg has a radius of gyration 20 cm. It is given a spin of 1000 r.p.m. about its axis which is horizontal. The flywheel is suspended at a point 15 cm from the plane of rotation of the flywheel. Find the velocity and direction of precession looking from top. [7]
 - b. An epicyclic gear train consists of an arm and two gears meshing externally. The two gears A and B have 40 and 50 teeth respectively. The wheel A is fixed and arm rotates about center of A. If the arm rotates at 200 r.p.m. in counter clockwise direction, determine the speed and direction of B by (a) algebraic method and (b) by tabular method. [7]
