INDAIN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATIONS – DECEMBER 2018
B. Tech (Marine Engineering)
Semester – III
Mechanics Of Machine-I (UG11T3305)

Date: 07.01.2019 Max marks: 100
Time: 3hrs Pass marks: 50

PART-A

Q1) Answer the following (10x3=30 Marks)

a) Define rubbing velocity at a pin joint, what will be the rubbing velocity at pin joint when the two links move in same direction?

b) Explain the term kinematic link. Give the classification of kinematic link.

c) Explain the terms i) Module ii) Pressure angle iii) Addendum, for gears

d) What do you understand by " GEAR TRAIN "?, Enlist the various types of gear trains

e) What are the various types of the torques in an epicyclic gear train?

f) Define the terms "Fluctuation of energy ".

g) Why the roller follower is preferred to that of knife –edge follower?

h) Explain in short effect of gyroscopic couple on a naval ship during pitching.

i) What do you understand by the term "Interference"as applied to gears?

j) Explain in short " Aronhold Kennedy's Theorem ".

PART-B

Answer any 5 of the following (5×14=70 marks)

Q2). During Forward stroke of the piston of the double acting steam engine, the turning moment has the maximum value of 2000 N-m when the crank makes an angle of 80° with the inner dead center. During the backward stroke, the maximum turning moment is 1500 N-m when the crank makes an angle of 80° with the outer dead Centre. The turning moment diagram for the engine can be assumed for simplicity to be represented by two triangles.

If the crank makes 100 rpm and the radius of gyration of the flywheel is 1.75m, find the coefficient of fluctuation of energy and the mass of

flywheel to keep the speed within ±0.75% of the mean speed. Also determine the crank angle at which the speed has its minimum and maximum value. (14 Marks)

Q3). The mechanism of a wrapping machine as shown in **FIG.1** has the following dimensions

O_1A= 100 mm, AC = 700 mm, BC=200 mm, O_3C=200 mm,O_2E=400 mm, O_2D=200 mm and BD=150 mm

The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of the point E of the bell crank lever by **Instantaneous Centre Method.**

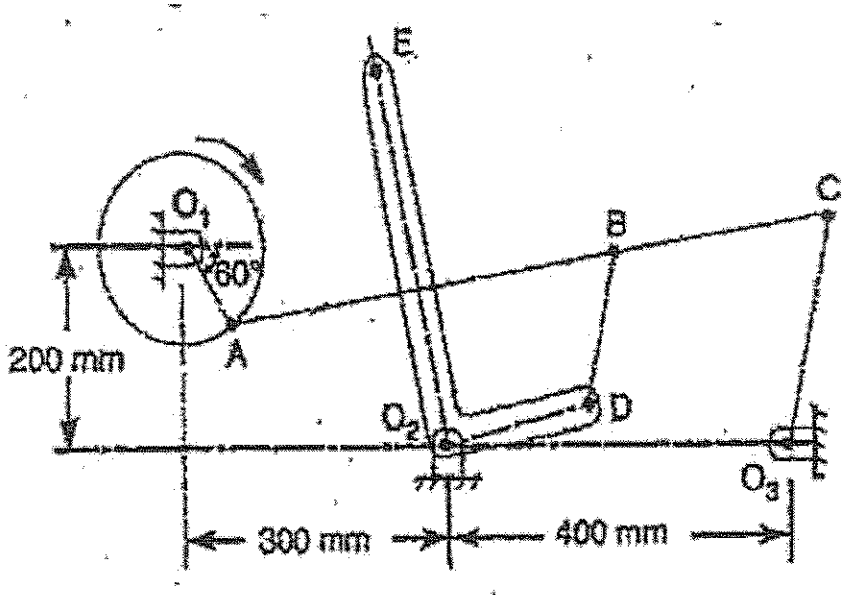

FIG.1 (14 Marks)

Q4). Construct the profile of a CAM to suit the following specifications.

Camshaft diameter = 40 mm, Least radius of cam 25 mm. Diameter of roller=25 mm, Angle of lift= 120°, angle of fall = 150°, lift of the follower = 40 mm, number of pauses are two of equal interval between motions.

(14 marks)

Q5). Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each of the pitch point has half the maximum possible length.

Determine the addendum height for each gear wheel. Length of the path of contact, arc of contact and contact ratio. (14 marks)

Q6). A drive on a machine tool is to be made by two spiral gear wheels, the spirals of which are of the same hand and has a normal pitch of 12.5 mm. The wheels are of equal diameter and the Centre distance between the axes of the shaft is approximately 134 mm. The angle between shafts is 80° and the speed ratio 1.25. Determine a) The spiral angle of each wheel. b) The number of teeth on each wheel. c) efficiency of the drive if the friction angle 6° .d) The maximum efficiency. (14 marks)

Q7). 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 = 18

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 marks)

Q8). A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 rpm. The rotor has a radius of gyration of 0.5 m and rotates in clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions:

a) The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.

b) The ship pitches 6° above and 6° below the horizontal position, the bow is descending with a maximum velocity. The motion due to pitching is simple harmonics and periodic time is 20 seconds.

c)The ship rolls and at a certain instant it has a angular velocity of 0.03 rad/s clockwise when viewed from stern

Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effects is determined in each case. (14 marks)

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