

INDIAN MARITIME UNIVERSITY
Time Bound Assignment
B Tech (ME) Arrear Examinations
September/October 2020
UG11T3305
Mechanics of Machines-I

Date: 17/09/2020
Duration: 3 Hrs

Max Marks: 70
Pass Marks: 35

Part – A (compulsory)
Answer the following (10x2=20 Marks)

[This may contain problems or few descriptive type questions or one mark questions or combinations]

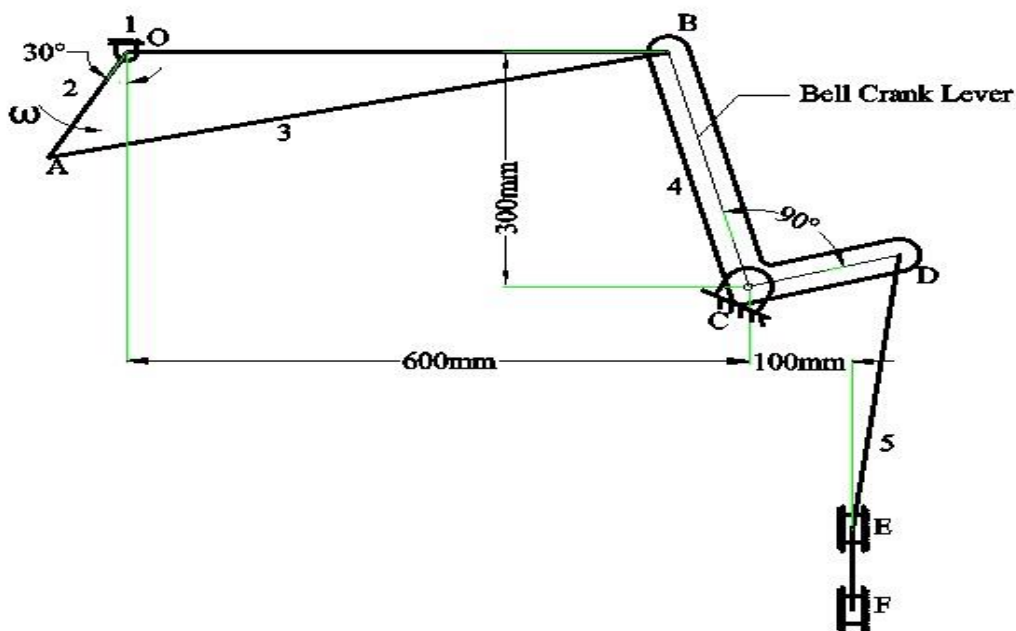
1. What are the steps to be followed in determining the turning moment diagram and what are its uses?
2. Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed', in the case of flywheels
3. Define instantaneous center of a link and name different types of instantaneous centers and their properties.
4. What is the importance of finding accelerations at various points in a mechanism? Name two different methods of finding acceleration
5. Draw the sketches of (a) Knife edge follower, (b) Roller follower of cams and followers, (c) Cylindrical cam with reciprocating follower and (d) Cylindrical cam with oscillating follower
6. Define the following terms as applied to cam with a neat sketch :(a) base Circle, (b) trace point, (c) Pressure angle, (d) Pitch circle and (e) pitch curve
7. What do you understand by the term 'interference' as applied to gears?
8. What is the effect of center distance variation on speed ratio in gears?
9. What are the various types of the torques in an epicyclic gear train
10. Discuss the gyroscopic effect on sea vessels

Part – B

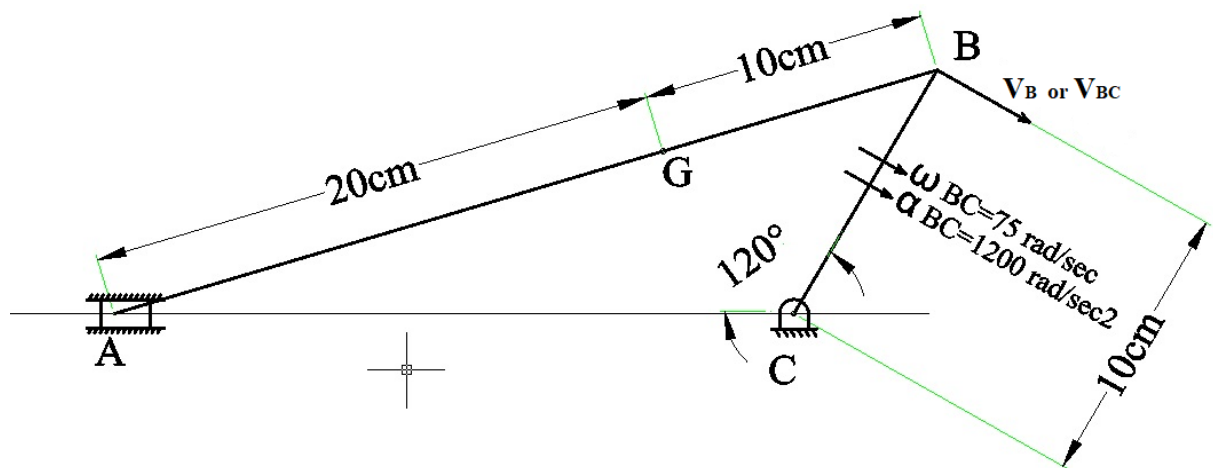
Answer any 5 out of 7 questions (5 x 10= 50 marks)

[This section may contain problem or group of problems/descriptive type questions]

11. The turning moment diagram for a multi cylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: + 52, - 124, + 92, - 140, + 85, - 72 and + 107 mm², when the engine is running at a speed of 600 r.p.m. If the total fluctuation of speed is not to exceed $\pm 1.5\%$ of the mean, find the necessary mass of the flywheel of radius 0.5 m. **(10 Marks)**
12. An engine crankshaft drives a reciprocating pump through a mechanism, as shown in Fig. The crank OA rotates in the counter-clockwise direction at 150 rpm. The diameter of the pump piston at F is 180 mm and OA = 175 mm, AB = 650 mm, CD = 160 mm, and DE = 600 mm Determine (a) the velocity of cross head E, (b) the rubbing velocities at pins A, B, C, and D having diameters of 40 mm each, and (c) the torque required at the crank to overcome a pressure of 0.35 MPa at the pump piston at F. **(10 Marks)**



13. A reciprocating engine mechanism is shown in fig. The crank $CB=10\text{cm}$ and connecting rod $BA=30\text{cm}$ with the center of gravity G , 10cm from B . In this position shown, the crank has a velocity of 75rad/s and an angular acceleration of 1200rad/s^2 . Find: a) the velocity and acceleration of G and b) the angular velocity and angular acceleration of AB . **(10 Marks)**



14. A cam is to give the following motion to a knife-edged follower:
 1. Outstroke during 60° of cam rotation; 2. Dwell for the next 40° of cam rotation; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 200° of cam rotation. The stroke of the follower is 50mm and the minimum radius of the cam is 65mm . The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft. **(10 Marks)**
15. (a) Draw a suitable sketch of epicyclic gear train and find velocity ratio between input and output
 (b) Explain difference between spiral gear and helical gear **(5+5 Marks)**
16. Two 20° involute spur gears mesh externally and give a velocity ratio of 3. The module is 3mm and the addendum is equal to 1.1 module. If the pinion rotates at 120rpm , determine the a) minimum number of teeth on each wheel to avoid interference, b) contact ratio. **(10 Marks)**

17. The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 3000 rpm clockwise when looking from stern. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots (1 knot=1855 m/hr). Calculate also the torque and its effect when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 and total angular displacement between the two extreme positions of pitching is 12° . Find the maximum acceleration during pitching motion. **(10 Marks)**

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