Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2023

Programme Name: B. Tech (Marine Engineering)

Semester: III

Subject Code: UG11T4308

Subject Name: MECHANICS OF MACHINES

Date: 20.12.2023	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The two parallel and coplanar shafts are connected by gears having teeth parallel to the axis of the shaft. This arrangement is called

   (a) spur gearing

   (b) helical gearing

   (c) bevel gearing

   (d) spiral gearing

2. In order to have a complete balance of the several revolving masses in different planes

   (a) the resultant force must be zero

   (b) the resultant couple must be zero

   (c) both the resultant force and couple must be zero

   (d) none of the above

3. According to Grashoff's Law in a four-bar mechanism having links of lengths 4, 6, 8 and 5 cm taken in an order, if 4 cm link is fixed then mechanism formed will be

(a) Double Crank Mechanism

(b) Crank Lever Mechanism

(c) Double Lever Mechanism

(d) Not a Mechanism

4. In a four-stroke engine, the crank shaft speed is

(a) same as cam shaft speed

(b) twice the cam shaft speed

(c) thrice the cam shaft speed

(d) None of the above

5. In worm gears if the efficiency of drive is less than 50%, it is called

(a) Reversible

(b) Self-locking

(c) Conjugate

(d) All of the above

6. The unbalanced force due to reciprocating masses

(a) Varies in magnitude but constant in direction

(b) Varies in direction but constant in magnitude

(c) Varies in magnitude and direction both

(d) Constant in magnitude and direction both

7. Which of the following is a higher pair?

(a) lead screw of lathe

(b) cam and follower

(c) journal bearing

(d) All of the above

8. A mass m attached to a shaft rotating at ω rad/sec at radius r cm from axis of the shaft is balanced by mass β at radius b cm from the axis of shaft. If the speed of the shaft is doubled, the value of balance mass β will be

(a) Doubled

(b) Quadrupled

(c) Unaffected

(d) Halved

9. In a ball bearing, ball and bearing forms a

(a) Turning pair

(b) Screw Pair

(c) Rolling Pair

(d) Spherical Pair

10. The offset is provided to a cam follower mechanism to

(a) minimise the side thrust

(b) accelerate

(c) avoid jerk

(d) None of these

Section B

Five Questions of 02 Marks each

11. What are the advantages and limitations of gear drive? Write any two each

12. Explain Static Balance and Dynamic Balance as applied to rotating masses

13. Show the nature of the plots of displacement, velocity, acceleration in case of a follower moving with SHM (Simple harmonic motion)

14. What is kinematic mechanism and when it is called structure?

15. What is "Engine Rocking" resulting from partial balancing?

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A pinion with 23 teeth is in mesh with a gear of 57 teeth. The pressure angle is 20 degrees. Addendum for both pinion and gear is 6 mm. Module is 6 mm. The pitch line velocity is 1.5 m/s.

Find: (a) length of path of approach (b) length of path of recess (c) length of path of contact (d) length of arc of contact (e) angular velocity of both

pinion and gear (f) sliding velocity at start of engagement (g) sliding velocity at disengagement.

17. A shaft carries four masses A, B, C and D placed in parallel planes perpendicular to the shaft axis and in the same order along the shaft. The masses B and C are 36 kg and 25 kg and both are assumed to be concentrated at a radius of 150 mm, while the masses A and D both are assumed to be concentrated at a radius of 200 mm. The angle between B and C is 1000 and that between B and A is 1900, both angles being measured in the same sense i.e. Counter-clockwise direction. The planes containing A and B are 250 mm apart and those containing B and C are 500 mm apart. If the shaft is to be in complete static and dynamic balance, find

    i) The masses A and D
    ii) The distance between planes C and D
    iii) The angular position of D.

18. (a) A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke.

(5 Marks)

(b) Describe the Equivalent Dynamical System

(5 Marks)

19. A cam is to be designed for a knife edge follower with the (a) Cam lift is 40 mm during 90° of cam rotation with simple harmonic motion, (b) Dwell for the next 30°, (c) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion and (d) Dwell during the remaining 180°.

20. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively.

    (a) Find the required mass A and

(b) The relative angular settings of the four masses so that the shaft shall be in complete balance.

21. State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing.

22. A two stroke five cylinder in-line engine has a firing order of 1-4-5-3-2-1. the centre lines of cylinders are spaced at equal intervals of 240 mm. the reciprocating parts per cylinder have a Mass of 2.8 kg; the piston stroke is 180 mm; and the connecting Rods are 390 mm long; the engine rotates at 1000 rpm. Discuss the primary and secondary balancing and values of Maximum unbalanced couples about the central plane.

Sir,

1. Please refer to QP UG11T4308.

2. Please read Qn. No. 19 as follows:

Quote

A cam is to be designed for a knife edge follower with the (a) Cam lift is 40 mm during 90° of cam rotation with simple harmonic motion, (b) Dwell for the next 30°, (c) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion and (d) Dwell during the remaining 180°.

Draw the profile of the cam when,

The line of stroke of the follower passes through the axis of the camshaft.

The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m.

Unquote

Please disseminate the same to the students concerned.