Indian Maritime University

(A Central University, Go8vt of India)

End Semester Examinations – December 2024

Programme Name: B Tech (ME)

Semester: III

Subject Code: UG11T4308

Subject Name: Mechanics of Machines

Date: 23.12.2024	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 **(1×10=10)**– Choose the correct answer as applicable.

1. Lower pairs are those which have
   A. Point or line contact between the two elements when in motion
   B. Surface contact between the two elements when in motion
   C. Elements of pairs not -held together mechanically
   D. Two elements that permit relative motion
2. Whitworth quick return mechanism is obtained by inversion of
   A. slider crank mechanism
   B. kinematic chain
   C. five link mechanism
   D. roller cam mechanism
3. _____ is the simplest type of motion and is along a straight line path.
   A. plane motion
   B. rectilinear motion
   C. curvilinear Motion
   D. none of the mentioned

4. In a skew bevel gears, the axes are

(a) non-parallel and non-intersecting
(b) parallel and intersecting
(c) intersect, and the teeth are curved
(d) None

5. The product of the diametral pitch and circular pitch is equal to

(a) 1
(b) $1/\pi$
(c) 2π
(d) π

6. The partial balancing means
(a) balancing partially the revolving masses
(b) balancing partially the reciprocating masses
(c) best balancing of engines
(d) all of the above

7. 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

8. When the axes of first and last gear are co-axial, then gear train is known as
(a) simple gear train
(b) compound gear train
(c) epicyclic gear train
(d) reverted gear train

9.The balancing of rotating and reciprocating parts of an engine is necessary when it runs at

A. slow speed B. medium speed C. high speed
D. none of the mentioned

10. In a radial cam, the follower moves

(a) in a direction perpendicular to the cam axis
(b) in a direction parallel to the cam axis
(c) in any direction irrespective of the cam axis
(d) along the cam axis

Section B

Five Questions of 02 Marks each

11.Define Grashoff's law

12.Differentiate: static and dynamic balancing.

13. Why the involute gears are more commonly used in actual practice, compared to cycloidal gears.

14.What are the classifications of follower according to follower shape?

15.Why balancing is so important?

Section C

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

16.Sketch and explain the following inversions of a slider crank chain

(i) Pendulum pump or Bull engine. (4 marks)

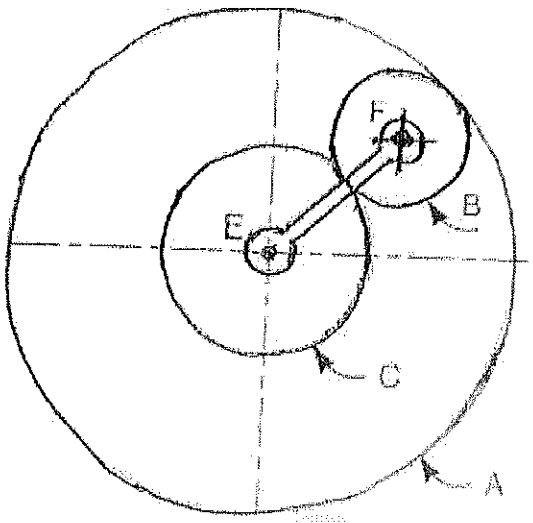
(ii) Crank and slotted lever quick return motion mechanism (6 marks)

17. (a) What you understand by Equivalent dynamic system, what are the essential condition of placing the two masses, so that the system become dynamic equivalent. **(3)**

(b) State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing. **(7)**

18. Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find, (a) The angle turned through by pinion when one pair of teeth is in mesh, and (b) The maximum velocity of sliding. **(10)**

19. An epicyclic gear consists of three gears A, B and C as shown in Fig. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m.. If the gear A is fixed, determine the speed of gears B and C



(10)

20. Design a cam for a knife edge follower with the given data: 1. Cam lift is 40 mm during 90° of cam rotation with simple harmonic motion, 2. Dwell for the next 30°, 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion and, 4. 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 cam shaft.

(10)

21.A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine : 1. The magnitude of the masses at A and D ; 2. the distance between planes A and D ; and 3. the angular position of the mass at D. **(10)**

22. The three cranks of a three-cylinder locomotive are all on the same axle and are set at 120°. The pitch of the cylinders is 1 metre and the stroke of each piston is 0.6 m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for each outside cylinder and the planes of rotation of the balance masses are 0.8 m from the inside crank. If 40% of the reciprocating parts are to be balanced, find the magnitude and the position of the balancing masses required at a radius of 0.6 m. **(10)**