Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations – March/April 2024

Programme Name: B Tech (ME)

Semester: III

Subject Code: UG11T4308

Subject Name: Mechanics of Machines

Date: 17.04.2024 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

Q.1 Which of the following is a higher pair?
A. cam and follower B. journal bearing
C. lead screw of lathe D. All of the above

Q.2 In a ball bearing, ball and bearing forms a
A. Turning pair B Screw Pair
C. Rolling Pair D. Spherical Pair

Q.3 Gear drive used in purifier is
A. Worm-worm wheel with worm shaft as driver
B. Bevel Gear
C. Herringbone Gear
D. Worm-worm wheel drive with the worm wheel as driver

Q. 4 A four bar mechanism having links of lengths 5, 6, 7 and 5 cm taken in an order. When 7 cm link is fixed the mechanism will be a
(A) Double Crank Mechanism (B) Crank Lever Mechanism
(C) Double Lever Mechanism (D) Not a Mechanism

Q.5 The unbalance in a rotor is produced due to
(A) Centripetal forces (B) Centrifugal forces
(B) Inertia forces (D)Resistive forces

Q.6 In four stroke high speed marine engine the gears used to transmit power from crankshaft to cam shaft for valve operation are
A. Helical gear B Bevel gear C. Spiral gears D. Worm gears

Q.7 The number of kinematic pairs in case of slider crank mechanism will be

(A) 4 (B) 3 (C) 5 (D) None

Q.8

The offset is provided to a cam follower mechanism to

(a) minimise the side thrust

(b) accelerate

(c) avoid jerk

(d) None of these

Q.9 The unbalanced force due to revolving 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

Q.10 In a four-stroke engine, the Gear ratio required for the gears used to transmit power from crankshaft to cam shaft to operate the valves is

(A) 1 (B) 4 (C) 3 (D) 2

Section B

Q.11 Give the names of all the Inversions of Single slider crank chain.
Q.12 What is "Engine Rocking" resulting from partial balancing
Q.13 Explain the Law of gearing or Conjugate action.
Q.14 Show the nature of the plots of displacement, velocity, acceleration in case of a follower moving with SHM (Simple harmonic motion)

Q.15 Show the plots reflecting the fluctuation of primary inertia forces and secondary inertia forces due to reciprocating parts of single cylinder two stroke engine in one crank rotation

Section C
Solve any five questions from the following

Q.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

[MARKS 10]

Q.17 A parallel helical gear pair with a centre distance of 245 mm transmits 9 kw power from 28 teeth left-hand pinion rotating at 1630 rpm to a helical gear rotating at 640 rpm mounted on a parallel shaft. The pressure angle in the plane of rotation 21.86 deg., and the helix angle is 25 deg., The pinion is above the gear and rotating clockwise direction looking from left hand side. With the help of FBD find the magnitude and direction of tangential, radial and axial components of tooth load.

[MARKS 10]

Q.18 A machine uses a crossed helical gear pair or spiral gear pair to transmit motion to a tool, the spirals of which are of the same hand and have a normal pitch of 11 mm. The wheels are of equal diameter and the centre distance between the axes of the shafts is approximately 134 mm. The angle between the shafts is 70 deg., and the speed ratio 1.4. Determine: 1. the spiral angle of each wheel,2. the number of teeth on each wheel, 3. the efficiency of the drive, if the friction angle is 6 deg., and 4. the maximum efficiency.

[MARKS 10]

Q.19 A planetary gear train has the internal gears A and B and compound gears C and D rotate independently about axis O. The gears E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the gears have the same module and the number of teeth is: TC = 30; TD = 28; TE = TF = 20.

a) Sketch the arrangement;

b) Find the number of teeth on A and B;

c) If the arm G makes 120 rpm clockwise and A is fixed, find the speed of B;

d) If the arm G makes 120 rpm clockwise and gear A makes 12 rpm counter clockwise; find the speed of gear B.

[MARKS 10]

Q.20 A cam operating roller follower has following specifications. The cam rotates at 1000 rpm. The follower to ascend through 31.4 mm with cycloidal motion during first 150 deg., of cam rotation and descend through 31.4 mm with cycloidal motion during next 150 deg., of cam rotation. The follower dwells for the remaining 60 deg., of cam rotation. The minimum radius of cam is 15 mm and radius of roller follower is 10 mm. The axis of cam is offset by 10 mm to the right from the axis of the follower. Draw cam-profile for the above.

[MARKS 10]

Q.21 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 100 deg., and that between B and A is 190 deg., 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.

[MARKS 10]

Q.22 A four stroke five cylinder in-line Engine is required to be examined for static and dynamic balance. It has a firing order of 1-4-5-3-2-1. The distance between centre lines is 150 mm and the reciprocating mass for each cylinder is 1.5 kg, the engine stroke length is 100 mm and the connecting rod length is 175 mm. The engine runs at 600 rpm. Examine the engine for balance and determine primary and secondary unbalance couples. Determine the angle when maximum value of primary couple would occur.

[MARKS 10]