

GANPAT UNIVERSITY
B.TECH SEM. IV - MARINE ENGINEERING
REGULAR EXAMINATION MAY/JUNE-2014
2MR405 MECHANICS OF MACHINES

Time: 3 Hours

Total Marks: 70

Instructions:

- 1). All questions are **compulsory**.
- 2). Figures to the **right** indicate full marks.
- 3). Answers to the two sections must be written in **separate** answer books.
- 4). Assume all necessary data.

SECTION I

- Que-1** (A) Differentiate giving examples: (06)
 (i) Lower and Higher Pairs, (ii) Closed and Unclosed Pairs, (iii) Turning and Rolling Pair.
- (B) Describe briefly the functions of elliptical trammel and scotch yoke. (06)
- OR**
- Que-1** (A) State and explain Grashof's criterion (06)
 (B) Explain degree of freedom with neat sketch. Also explain Grubler's criterion. (06)
- Que-2** O_2ABO_4 is a four bar mechanism, the link dimensions are $O_2A = 40$ mm, $AB = 80$ mm, $O_2O_4 = 100$ mm, $O_4B = 80$ mm. The crank O_2A rotates at constant angular velocity of 10 rad/sec. Determine velocity and acceleration of mid point M of the link AB. Angle $O_4O_2A = 60^\circ$. (11)
- OR**
- Que-2** (A) What are fixed centrode and moving centrode? (02)
 (B) In a pin jointed four bar mechanism, $O_2B = 500$ mm, $BC = CO_4 = 620$ mm and $O_2O_4 = 800$ mm. The angle $BO_2O_4 = 60^\circ$. The crank O_2B rotates uniformly at 100 r.p.m. locate all the instantaneous centers and find the angular velocity of the of the link BC. (09)
- Que-3** Attempt any three. (12)
- (A) Sketch and explain the various inversion of single slider crank chain.
- (B) What is instantaneous centre? Discuss the three types of instantaneous centre for mechanism.
- (C) Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed', in the case of flywheels.
- (D) 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.

SECTION II

Que-4 (A) Evaluate – “The common normal at the point of contact between a pair of teeth must always pass through the pitch point” (04)

(B) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form. Module = 6 mm, addendum = one module, pressure angle = 20° . The pinion rotate at 90 r.p.m. Determine: (1) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, (2) The length of path and arc of contact, (3) The number of pair teeth in contact, (4) The maximum velocity of sliding. (08)

OR

Que-4 (A) Explain the term related to gear: (1) Module, (2) Pressure angle, (3) Addendum (4) Dedendum. (04)

(B) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? (08)

Que-5 (A) Why a roller follower is preferred to that of a knife edged follower? (02)

(B) Construct cam profile for a knife edge follower. Minimum radius of cam = 30 mm, Stroke of follower = 24 mm, Angle of rise = 90° , Dwell after rise = 60° , Angle of return = 120° , Dwell after return for rest of the period. Follower to move outwards with uniform velocity and return back with simple harmonic motion. The follower is offset to right by 15 mm. (09)

OR

Que-5 (A) Define the term as referred to cams (a) Pitch circle, (b) Prime circle, (c) Base circle. (02)

(B) A cam operates a flat faced follower which moves with cycloidal motion during ascent and descent. The further specifications are: (09)

Min radius of cam = 30 mm Angle of ascent = 120° Angle of dwell = 60°

Lift of follower = 40 mm Angle of decent = 90° speed of cam = 300rpm

Draw cam profile .Find max velocity and acceleration during ascent and decent

Que-6 **Attempt any three** (12)

(A) With the help of neat sketches explain the types of follower.

(B) Derive an expression for length of the path of contact two involutes profile gear in mesh.

(C) Explain epicyclic gear train. What are its merits and demerits as compared to reverted gear train and compound gear train.

(D) Determine the minimum no of teeth required on pinion and wheel to avoid interference when gear ratio is 3 and when number of teeth on pinion and wheel is equal (take pressure angle = 20° and addendum of wheel is 1 module).

END OF PAPER