

GANPAT UNIVERSITY
B. Tech. Semester: 4th Mechanical Engineering
CBCS Regular Examination April - June 2015
2ME404 Dynamics of Machines

Time: 3 Hours

Total Marks: 70

- Instructions:** 1. All questions are compulsory.
 2. Assume suitable data if necessary.
 3. Figures to the right indicates full marks

SECTION – I

- Que.1** (a) Derive the equations for effort and power of a governor. [06]
- (b) In a spring loaded Hartnell type governor, the mass of each ball is 4kg and the lift of sleeve is 40mm. The governor begins to float at 200rpm when the radius of ball path is 90mm. The mean working speed of governor is 16 times the range of speed when friction is neglected, The length of ball and roller arms of the bell crank lever are 100mm and 80mm respectively. The pivot centre and axis of governor are 115 mm apart. Determine the initial compression of spring, taking into account the obliquity of arms. [06]
 Assuming the friction at the sleeve to be equivalent to a force of 15N, determine the total alteration in speed before the sleeve begin to move from the mid position.

OR

- Que.1** (a) What is the function of governor? Explain Wilson hartnell governor. [06]
- (b) A porter governor has equal arms of 240 mm length each and pivoted on the axis of rotation. Each ball is of 50 N weight and the weight of central load is 250 N. The radius of rotation of the ball is 150 mm when the governor begins to rise and 200 mm when the governor is at maximum speed. When friction at sleeve is neglected. Find : [06]
- 1) The range of speed,
 - 2) Sleeve lift,
 - 3) Governor effort and
 - 4) Power of governor

- Que. 2** (a) Explain the law of gearing and velocity of sliding gear. [05]
- (b) The pressure angle of two gear in mesh is 20° and have a module of 10 mm. The numbers of teeth on pinion are 24 and on gear 60 .The addendum of pinion and gear is same and equal to one module. Determine: [06]
- 1) The number of pairs of teeth on contact,
 - 2) The angle of action of pinion and gear, and
 - 3) The ratio of sliding to rolling velocity at beginning of contact, at pitch point and at the end of contact.

OR

- Que. 2 (a) Derive an expression for the minimum number of teeth required on wheel in order to avoid interference in involute gear teeth when it meshes with pinion. [05]
- (b) Two gears in mesh have a module of 8 mm and pressure angle of 20° . The larger gear has 57 teeth while pinion has 23 teeth. If the addendum on pinion and gear wheels are equal to one module, find [06]
- 1) The number of pairs of teeth in contact
 - 2) The angle of action of pinion and gear wheel
 - 3) The ratio of sliding to rolling velocity at
 - a) The beginning of contact
 - b) The pitch point
 - c) The end of contact

Que.3 Attempt Any Three. [12]

- (a) Compare cycloidal teeth and involute teeth.
- (b) Explain Watt governor.
- (c) What is the condition of isochronism in governor? In what type of governors can it be achieved?
- (d) Define following terms:
 - 1) Path of contact
 - 2) Arc of contact
 - 3) Angle of action
 - 4) Angle of Obliquity

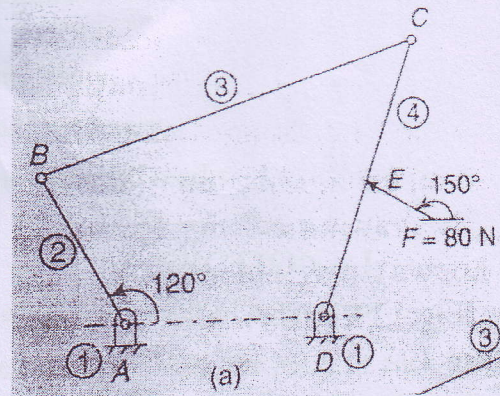
SECTION – II

- Que.4 (a) Explain Analytical Method for velocity and acceleration of the Piston. [06]
- (b) The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm^2 . The connecting rod length between centres is 1.2 m and cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected, calculate: [06]
- | | |
|--|--|
| (1) Pressure on slide bars | (2) Thrust in the connecting rod, |
| (3) Tangential force on the crank-pin, and | (4) Turning moment on the crank shaft. |

OR

- Que.4 (a) The crank and connecting rod of a steam engine are 0.3 m and 1.5 m in length. The crank rotates at 180 r.p.m. clockwise. Determine the velocity and acceleration of the piston when the crank is at 40° from the inner dead centre position. Also determine the position of the crank for zero acceleration of the piston. [06]
- (b) Explain D'Alembert's Principle and Draw Klien's construction diagram. [06]

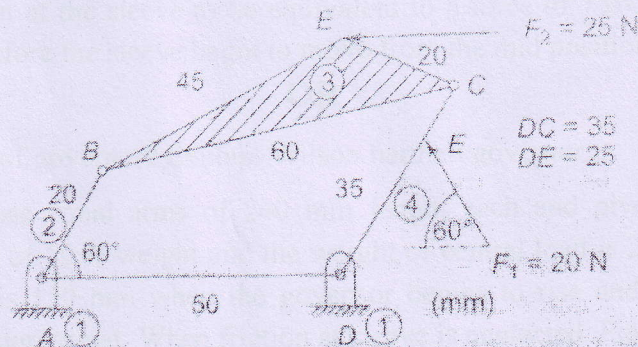
- Que.5 (a) A Four - link mechanism with the following dimensions is acted upon by a force 80N at 150° on the link DC. AD = 500mm , AB = 400 mm, BC = 1000 mm , DC = 750 mm, DE = 350 mm. Determine the input torque T (by graphical method) on the link AB for the static equilibrium of the mechanism for the following given configuration. [07]



- (b) What is the need of static force analysis? Explain the principle of superposition. [04]

OR

- Que.5 (a) For the mechanism as shown in following fig. determine the torque on the link AB for the static equilibrium of the mechanism. [07]



- (b) Explain the principle of virtual work [04]

- Que.6 Attempt Any Three. [12]

- (a) Explain Gyroscopic Couple with example of aero plane.
- (b) Explain any one intermittent motion mechanism.
- (c) A four bar mechanism is to be designed, by using three precision points, to generate the function $Y=X^{1.5}$ for the range $1 \leq X \leq 4$. Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of X and Y only, corresponding to the three precision points.
- (d) Why Hook joint use in automobile? Give any four application of the universal joint.

End of Paper