

CBCS Scheme

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15MT45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Theory of Machines

Time: 3 hrs.

Max. Marks: 80

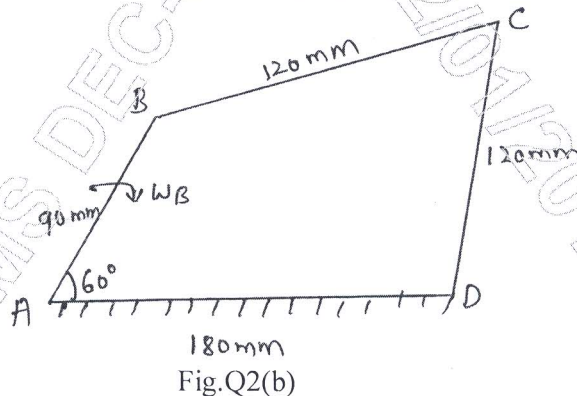
Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Define the following: (06 Marks)
- Machine,
 - Inversion,
 - Degree of Freedom
- b. With a neat sketch, explain: (10 Marks)
- Quick return motion mechanism
 - Geneva wheel

OR

- 2 a. With a neat sketch, explain Ratchet and Pawl mechanism. (06 Marks)
- b. A four bar mechanism ABCD is made up of four links, pin jointed at the ends. 'AD' is fixed link which is 180 mm long. The links AB, BC and CD are 90 mm, 120 mm and 120 mm long respectively as shown in Fig.Q2(b). At certain instant, the link AB makes an angle of 60° with the link AD. If the link AB rotates at a uniform speed of 100 rpm clockwise. Determine: (10 Marks)
- Angular velocity of the links BC and CD
 - Angular acceleration of the links CD and CB.



Module-2

- 3 a. Explain law of gearing. (06 Marks)
- b. A spur gear of 20° pressure angle running at 200 rpm drives another gear at a speed of 100 rpm. A centre distance between the two gears is 300 mm and module is 5 mm. Determine: (10 Marks)
- Pitch circle radius of pinion
 - Pitch circle radius of gear
 - Number of teeth on gear
 - Number of teeth on pinion
 - Base circle radius of pinion

OR

- 4 a. Explain different types of gear trains. (06 Marks)
- b. In an epicyclic gear train shown in Fig.Q4(b), the arm A is fixed to the shaft 'S' the wheel 'B' having 100 teeth rotates freely on this shaft 'S' wheel 'F' 150 teeth is separately driven. If the arm A runs at 200 rpm, wheel F at 100 rpm in the same direction. Find:
- Number of teeth of gear C
 - Speed of wheel B.

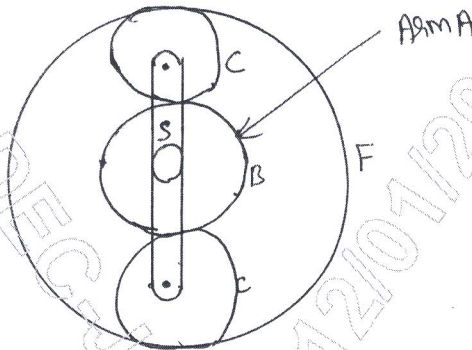


Fig.Q4(b)

(10 Marks)

Module-3

- 5 a. Define Cam. Explain the classification of cams. (06 Marks)
- b. A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5 cm diameter. The follower motion is defined as below:
- Outward during 150° with UARM
 - Dwell for next 30°
 - Return during next 120° with SHM
 - Dwell for the remaining period.
- Stroke of the follower is 3 cm. Minimum radius of the cam is 3 cm. Draw the cam profile when follower axis passes through cam axis. (10 Marks)

OR

- 6 A cam with 3 cm as minimum radius of rotation clockwise at a uniform speed of 1200 rpm and has to give the motion to the knife edge follower as defined below:
- Follower to move outward through 3 cm during 120° of cam rotation with SHM.
 - Dwell for next 60° .
 - Follower to return to its starting position during the next 90° with UARM.
 - Dwell for the remaining period.
- Draw the cam profile when follower axis passes through cam axis and also determine maximum velocity and maximum acceleration during outward and return stroke. (16 Marks)

Module-4

- 7 A shaft carries 4 rotating masses ABCD in third order along the axis. The mass A may be assumed to be concentrated at 160 mm radius, B at 180 mm, C at 200 mm and D at 120 mm radius. The masses B, C and D are 40, 30 and 50 kg respectively. The planes containing B and C are 300 mm apart. The angular spacing of C and D are 90° and 210° respectively with respect to B measured in the same direction. If the shaft and masses are to be in complete dynamic balance, determine:
- Mass and angular position of A
 - Position of planes A and D.
- (16 Marks)

OR

- 8 a. Derive the expression for the ratio of tension in flat belt drives. (08 Marks)
- b. The diameter of a pulley mounted on a shaft rotating at 250 rpm is 0.75 m. A counter shaft is to be driven at 500 rpm by an open belt drive. The coefficient of friction is 0.3 and distance between centres = 2.5 m. Determine the necessary belt width to transmit 12 KW if safe pull on the belt is not to exceed 25 N/mm^2 . Width of belt. (08 Marks)

Module-5

- 9 a. Define the following:
i) Sensitiveness
ii) Hunting
iii) Stability (06 Marks)
- b. Each arm of a porter governor is 300 mm long and is pivoted on the axis of the governor. Each ball has a mass of 6 kg and the mass of sleeve is 18 kg. The radius of rotation of ball is 200 mm when the governor begins to lift and 250 mm when the speed is maximum. Determine the maximum and minimum speed and also determine the range of speed of governor. (10 Marks)

OR

- 10 a. Derive an expression for the gyroscopic couple. (06 Marks)
- b. The mass of the rotary engine of an aeroplane is 400 kg and has radius of Gyration 300 mm. When viewed from the front, the engine rotates in clockwise direction at 1500 rpm. When flying at 180 km/hr, the aeroplane loops in a circle of 40 m diameter in a vertical plane tending to raise the nose. Find magnitude and direction of gyroscopic couple acting on the aeroplane. (10 Marks)
