

# C.U.SHAH UNIVERSITY

## Winter Examination-2015

Subject Name : Theory of Machines

Subject Code : 4TE04TOM1

Branch : B.Tech (Mech)

Semester : 4 Date : 23/11/2015

Time : 2:30 To 5:30

Marks : 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1

Attempt the following questions:

(14)

- a) The Brakes commonly used in railway train is
  - (a) Shoe Brake
  - (b) Band Brake
  - (c) Band & Block Brake
  - (d) Internal expanding brake
- b) When the pitching of a ship is upward, the effect of gyroscopic couple acting on it will be
  - (a) to move the ship towards port side
  - (b) to move the ship towards star-board
  - (c) to raise the bow and lower the stern
  - (d) None of the these
- c) The ratio of maximum fluctuation of speed to the mean speed is called
  - (a) fluctuation of speed
  - (b) maximum fluctuation of speed
  - (c) coefficient of fluctuation of speed
  - (d) None of these
- d) In an engine, the work done by inertia forces in a cycle is
  - (a) Positive
  - (b) Zero
  - (c) Negative
  - (d) None of these
- e) The axis of precession is .....to the plane in which the axis of spin is going to rotate.
  - (a) Parallel
  - (b) Inclined
  - (c) perpendicular
  - (d) None of these
- f) The Klein's diagram is useful to find.....of various parts.
  - (a) displacement
  - (b) acceleration
  - (c) velocity
  - (d) angular acceleration
- g) In a four stroke I.C. engine, the turning moment during the compression stroke is
  - (a) positive throughout
  - (b) Positive during major portion of stroke
  - (c) Negative throughout
  - (d) Negative during major portion of stroke
- h) A watt's governor can work satisfactorily at speeds from
  - (a) 60 to 80 r.p.m.
  - (b) 80 to 100 r.p.m
  - (c) 100 to 200 r.p.m.
  - (d) 200 to 300 r.p.m
- i) Which of the following is phase of synthesis?
  - (a) Type synthesis
  - (b) Number synthesis
  - (c) Dimensional synthesis
  - (d) All of these



- j) In a turning moment diagram, the variations of energy above and below the mean resisting torque line is called  
 (a) minimum fluctuation of energy (b) maximum fluctuation of energy  
 (c) coefficient of fluctuation of energy (d) fluctuation of energy
- k) Which of the following is a spring controlled governor?  
 (a) Hartnell governor (b) Hartung governor  
 (c) Wilson-Hartnell governor (d) All of these
- l) Which of the following is an absorption type dynamometer?  
 (a) Prony brake dynamometer (b) epicyclic-train dynamometer  
 (c) torsion dynamometer (d) All of these
- m) Which of the following governor is used to drive a gramophone?  
 (a) Watt governor (b) Porter governor  
 (c) Pickering governor (d) Hartnell governor
- n) When the relation between the controlling force ( $F_c$ ) and radius of rotation ( $r$ ) for a spring controlled governor is  $F_c = ar + b$ , then the governor will be  
 (a) Stable (b) Unstable  
 (c) Isochronous (d) None of these

**Attempt any four questions from Q-2 to Q-8**

**Q-2 Attempt all questions**

- (a) List and explain mechanical brakes. (04)  
 (b) Derive condition of self locking and self energizing for simple shoe or block brake. (05)  
 (c) Describe the construction and operation of a rope brake absorption dynamometer. (05)

**Q-3 Attempt all questions**

- (a) Prove that the maximum fluctuation of energy,  $\Delta E = 2.E.C_s$  (07)  
 Where,  $E$  = Mean kinetic energy of flywheel, and  
 $C_s$  = Coefficient of fluctuation of speed.
- (b) The turning moment diagram for a petrol engine is drawn to the following scales: (07)  
 Turning moment, 1 mm = 5 N-m; crank angle, 1 mm =  $1^\circ$ . The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm<sup>2</sup>. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.

**Q-4 Attempt all questions**

- (a) Discuss gyroscopic effects on naval ships. (07)  
 (b) The turbine rotor of a ship has mass of 2000 kg and rotates at 25 rev./sec clockwise (07)  
 when viewed from the stern. The radius of gyration of rotor is 0.30 meter. Determine gyroscopic couple and its effect when  
 (i) The ship turns right at a radius of 250 m with a speed of 25 km/hr.  
 (ii) The ship rolls at an angular velocity of 0.1 rad/sec.



- Q-5**            **Attempt all questions**
- (a) Explain dynamically equivalent two mass system. (07)  
(b) State and explain D'Alembert's principle. (07)
- Q-6**            **Attempt all questions**
- (a) Define and discuss about effort and power of Governor. (04)  
(b) Derive the equation for the height of Watt Governor. (05)  
(c) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 15 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. (05)
- Q-7**            **Attempt all questions**
- (a) Explain: Function generation, path generation & motion generation. (07)  
(b) Explain two position synthesis for four bar mechanism. (07)
- Q-8**            **Attempt all questions**
- (a) Define and Explain the following terms related to governors : (06)  
(1) Sensitiveness (2) Stability (3) Isochronism.  
(b) A simple band brake is operated by a lever of length 500 mm. The brake drum has a diameter of 500 mm and the brake band embraces  $\frac{5}{8}$  of the circumference. One end of the band is attached to the fulcrum of the lever while the other end is attached to a pin on the lever 100 mm from the fulcrum. If the effort applied to the end of the lever is 2 kN and the coefficient of friction is 0.25, find the maximum braking torque on the drum. (08)

