

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Theory of Machines

Subject Code: 4TE04TOM1

Branch: B.Tech (Mechanical)

Semester: 4

Date: 15/5/2017

Time : 02:00 To 05:00

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) 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
- b) According to synthesis of mechanism, which synthesis step includes degree of freedom for a specified motion?
 - (a) Type synthesis
 - (b) Number synthesis
 - (c) Dimensional synthesis
 - (d) All of the above
- c) Which type of brakes have wooden blocks placed inside flexible steel band?
 - (a) Block brake
 - (b) Band brake
 - (c) Band and Block brake
 - (d) Pivoted block brake
- d) A disc is spinning with an angular velocity ω rad/s about the axis of spin. The couple applied to the disc causing precession will be
 - (a) $\frac{1}{2} I\omega^2$
 - (b) $I\omega^2$
 - (c) $I\omega\omega_p$
 - (d) $\frac{1}{2} I\omega\omega_p$
- e) Which among the following is not a type of error found in function generation?
 - (a) Structural error
 - (b) Mechanical error
 - (c) Graphical error
 - (d) None of the above
- f) Which of the following is an Absorption type Dynamometer?
 - (a) Thorneycroft dynamometer
 - (b) Rope brake dynamometer
 - (c) Epicyclic train dynamometer
 - (d) Torsion dynamometer
- g) Double block brake is a type of
 - (a) Band brake
 - (b) Internal expanding shoe brake
 - (c) Shoe brake
 - (d) None of the above



- h) 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
- i) When the crank is at the inner dead centre, in a horizontal reciprocating steam engine, then the velocity of the piston will be
 (a) Zero (b) minimum
 (c) maximum (d) none of these
- j) The axis of precession isto the plane in which the axis of spin is going to rotate.
 (a) Parallel (b) Inclined
 (c) perpendicular (d) None of these
- k) In an engine, the work done by inertia forces in a cycle is
 (a) Positive (b) Zero
 (c) Negative (d) none of these
- l) Gyroscopic effect is not observed in which of the following actions performed by the ships?
 (a) Rolling (b) Pitching
 (c) Steering (d) All of the above
- m) Turning moment diagram is a graph between
 (a) Torque and Crank angle (b) Torque and crank radius
 (c) Force and crank radius (d) none of the above
- n) A governor is said to be isochronous when equilibrium speed of all radii of rotation of the balls within the working range,
 (a) Is constant (b) Varies uniformly
 (c) Is not constant (d) None of the above

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

Q-2

Attempt all questions

- (a) Describe the construction and operation of a Prony brake absorption dynamometer (07)
- (b) A vehicle moving on a rough plane inclined at 10° with the horizontal at a speed of 36 km/h has a wheel base 1.8 metres. The centre of gravity of the vehicle is 0.8 metre from the rear wheels and 0.9 metre above the inclined plane. Find the distance travelled by the vehicle before coming to rest and the time taken to do so when 1. The vehicle moves up the plane, and 2. The vehicle moves down the plane. (07)
- The brakes are applied to all the four wheels and the coefficient of friction is 0.5.

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) A punching press is driven by a constant torque electric motor. The press is provided with a flywheel that rotates at maximum speed of 225 r.p.m. The radius of gyration of the flywheel is 0.5 m. The press punches 720 holes per hour; each punching operation takes 2 second and requires 15 kN-m of energy. Find the power of the motor and the minimum mass of the flywheel if speed of the same is not to fall below 200 r. p. m. (07)



- Q-4** **Attempt all questions**
- (a) Explain the following Terms: (1) Sensitiveness of Governors (2) Stability of Governors (04)
- (b) Explain Synthesis of a Function generation (04)
- (c) The arms of a Porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the governor. (06)
- Q-5** **Attempt all questions**
- (a) What is meant by a self locking and a self energized block brake? (04)
- (b) Define Governor. Also List the types of governor. (04)
- (c) State and explain D'Alembert's principle. (06)
- Q-6** **Attempt all questions**
- (a) Define and discuss about effort and power of Governor. (04)
- (b) Explain the terms: 'Co-efficient of fluctuation of Energy' and 'Co-efficient of fluctuation of Speed'. (04)
- (c) Explain dynamically equivalent two mass system. (06)
- Q-7** **Attempt all questions**
- (a) Explain the effect of the gyroscopic couple on naval ship. (07)
- (b) An aeroplane makes a complete half circle of 50 metres radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it. (07)
- Q-8** **Attempt all questions**
- (a) Explain the analytical method for dimensional synthesis of four bar mechanism. (Freudenstein's equation) (07)
- (b) 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 , y , θ and Φ corresponding to the three precision points. (07)

