Enrollment No: _____   Exam Seat No: _____

C.U.SHAH UNIVERSITY
Summer Examination-2016

Subject Name: Theory of Machines

Subject Code: 4TE04TOM1   **Branch: B.Tech (Mechanical)**

Semester: 4   **Date: 18/05/2016**   **Time: 02:30 To 05:30**   **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 brake commonly used in motor cars is
          (a) shoe brake   (b) band brake
          (c) band and block brake   (d) internal expanding brake
  b) The capacity of a brake depends upon
          (a) Unit pressure between braking surface
          (b) Coefficient of friction between braking surface
          (c) Ability to heat dissipation
          (d) All of above
  c) The height of a watt's governor (in metres) is equal to
          (a) $8.95/N^2$ (b) $89.5/N^2$ (c) $895/N^2$ (d) $8950/N^2$
          Where N= Speed of the arm and ball about the spindle axis.
  d) Which of the following is a spring controlled governor?
          (a) Hartnell   (b) Hartung   (c) Pickering   (d) all of these
  e) A hunting governor is
          (a) more stable (b) less sensitive (c) more sensitive (d) none of these
  f) Isochronism in a governor is desirable when
          (a) the engine operates at low speeds
          (b) the engine operates at high speeds
          (c) the engine operates at variable speeds
          (d) one speed is desired under one load
  g) The engine of an aeroplane rotates in clockwise direction when seen from the tail end
          and the aeroplane takes a turn to the left. The effect of the gyroscopic couple on the
          aeroplane will be:
          (a) to raise the nose and dip the tail   (b) to dip the nose and raise the tail
          (c) to raise the nose and tail   (d) to dip the nose and tail
  h) The maximum fluctuation of energy is the
          (a) sum of maximum and minimum energies

(b) difference between the maximum and minimum energies
(c) ratio of the maximum energy and minimum energy
(d) ratio of the mean resisting torque to the work done per cycle

i) Gyroscopic effect is not observed in which of the following actions performed by the ships?
(a) Rolling   (b) Pitching   (c) Steering   (d) all of these

j) The synthesis of mechanism deals with
(a) the determination of input and output angles of a mechanism
(b) the determination of dimensions of the links in a mechanism
(c) the determination of displacement, velocity and acceleration of the links in a mechanism
(d) none of the above

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) The rotor of a ship rotates in clockwise direction when viewed from the stern and the ship takes a left turn. The effect of the gyroscopic couple acting on it will be
(a) to raise the bow and stern   (b) to lower the bow and stern
(c) to raise the bow and lower the stern   (d) to lower the bow and raise the stern

m) The ratio of the maximum fluctuation of energy to the work done per cycle is called
(a) fluctuation of energy   (b) maximum fluctuation of energy
(c) coefficient of fluctuation of energy   (d) none of these

n) In a four stroke I. C. engine, the turning moment during the compression stroke is
(a) positive throughout
(b) negative throughout
(c) positive during major portion of the stroke
(d) negative during major portion of the stroke

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

Q-2   **Attempt all questions**

(a) What is the difference between absorption and transmission dynamometers?   **(3)**

(b) Enlist and explain mechanical brakes and also derive condition of self locking for simple shoe or block brake.   **(4)**

(c) A torsion dynamometer is fitted to a propeller shaft of a marine engine. It is found that the shaft twists 2^0 in a length of 20 m at 120 r.p.m. If the shaft is hollow with O. D. = 400 mm and I. D. = 300 mm, and modulus of rigidity of shaft material is 8×10^{10} N/mm^2. Find the power of the engine.   **(7)**

Q-3   **Attempt all questions**

(a) Draw and explain to the point turning moment diagram of a 4-Stroke single cylinder Engine.   **(7)**

(b) A horizontal cross compound steam engine develops 300 kW at 90 r.p.m. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within ± 0.5% of the mean speed. Find the weight of the flywheel required, if the radius of gyration is 2 metres.   **(7)**

Q-4   **Attempt all questions**

(a) Classify 'governors' and prove for Watt governor, height of the governor $h = 895/N^2$. Where N is speed of rotation of sleeve. **(7)**

(b) A porter governor has equal arms each 200 mm in length and pivoted on the axis of rotation. The mass of each ball is 5 kg and the mass of sleeve is 25 kg. The radius of governor is 100 mm when governor begins to lift. If the frictional increase of speed is 1%, then determine the governor effort and power. **(7)**

Q-5   **Attempt all questions**

(a) Discuss gyroscopic effects on naval ships. **(7)**

(b) The turbine of rotor of a ship has mass of 3000 kg. & radius of gyration of 0.4 m, and clockwise speed of 2500 r.p.m. when looking from stern. Determine gyroscopic couple and its effect when (i) The ship steers to the left on curve of 100 m radius at a speed of 36 km/hr. and (ii) When the ship is pitching in S.H.M., the bow falling with its maximum velocity. The period of pitching is 40 Sec. and the total angular displacement between the bow extreme positions of pitching is 12^0. **(7)**

Q-6   **Attempt all questions**

(a) What is meant by dynamically equivalent system? State and prove conditions for it. **(7)**

(b) A connecting rod is suspended from the point 25 mm above the small end centre and 650 mm above its C.G. it takes 35 seconds for 20 oscillations. Find dynamically equivalent system of two masses when the mass is located at small end centre. Mass of the connecting rod is 40 Kg. **(7)**

Q-7   **Attempt all questions**

(a) Define (i) Hunting (ii) Sensitiveness (iii) Sleeve lift and (iv) Isochronisms for governor. **(7)**

(b) Derive an expression for angle of heel of a two wheeler taking turn. **(7)**

Q-8   **Attempt all questions**

(a) Explain: Function generation, path generation & motion generation. **(7)**

(b) Determine the chebychev spacing for function $y = x^{1.5}$ for the range $0 \leq x \leq 3$ where three precision points are required. For these position points, determine θ_2, θ_3 and $\emptyset_2$, $\emptyset_3$ if $\Delta\theta = 40^{\circ}$ and $\Delta\emptyset = 90^{\circ}$. **(7)**