PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST - 1

Even Semester: 2018-19   **Date**: 05 March 2019

Course Code: MEC 214   **Time**: 1 Hour

Course Name: Dynamics of Machines   **Max Marks**: 40

Programme & Sem: B.Tech, (MEC) & VI Sem   **Weightage**: 20%

Instructions: *All the Questions are Compulsory.*

Part A
Answer **all** the Questions. **Each** question carries **four** marks.   (2Qx4M=8)

1. Define the following: i) Coefficient of Fluctuation of Speed, ii) Coefficient of Fluctuation of Energy, iii) Inertia, iv) Free Body Diagram.

2. Define Turning Moment Diagram and with the neat sketch label the salient features of Tuning Moment Diagram for single-cylinder 4-stroke engine.

Part B
Answer **all** the Questions. **Each** question carries **six** marks.   (2Qx6M=12)

3. With a neat sketch and usual notations derive the expression for angular velocity and angular acceleration of the connecting rod.

4. In a slider crank mechanism, the length of the crank and connecting rod are 160 mm and 500 mm respectively. The crank position is 60° from inner dead centre. The crank shaft speed is 600 RPM. (clockwise). Using analytical method, determine: i) Velocity and acceleration of the slider, and ii) Angular velocity and angular acceleration of the connecting rod.

Part C
Answer **all** the Questions. **Each** question carries **ten** marks.   (2Qx10M=20)

5. With a neat sketch and usual notations derive the expression for the velocity and acceleration of the piston and deduce the expression of the velocity thus obtained for the case where the length of connecting rod is bigger compared to crank radius.

6. A single cylinder double acting steam engine develops 200 kW at a mean speed of 90 RPM. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is ± 3% of mean speed. If the mean diameter of the flywheel rim is 2 metre and the hub and spokes provide 5% of the rotational inertia of the flywheel, find the mass and cross-sectional area of the flywheel rim. Assume the density of the flywheel material (which is cast iron) as 7200 kg/m^3.

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TEST - 2

Even Semester: 2018-19   **Date**: 15 April 2019

Course Code: MEC 214   **Time**: 1 Hour

Course Name: Dynamics of Machines   **Max Marks**: 40

Program & Sem: B.Tech & VI Sem   **Weightage**: 20%

Instructions:
- (i)   *The question paper consists of 3 parts(A,B and C)*
- (ii)   *All questions are compulsory.*
- (iii) *Read the questions carefully and answer accordingly.*
- (iv)   *Non Programmable scientific calculators are allowed*

Part A

Answer **both** the Questions. **Each** question carries **four** marks.   (2Qx4M=8)

1. Define the following terms with neat diagram:
     (i) Active Force   (ii) Reactive Force   (iii) Pitching in ships   (iv) Rolling in ships

2. The turbine rotor of a ship has a mass of 8 tones and a radius of gyration 0.6 m. It rotates at 1800 rpm. clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 kmph and steer to the left in a curve of 75 m radius

Part B

Answer **both** the Questions. **Each** question carries **six** marks.   (2Qx6M=12)

3. Explain the application of gyroscopic principles to aircrafts while taking left turn with the help of a neat diagram.

4. The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.60m. Its speed is 2000 rpm. The ship pitches 6° above and 6° below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic.

   Determine the following: 1. Maximum gyroscopic couple, 2. Maximum angular acceleration of the ship during pitching, and 3.The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the left.

Part C

Answer **both** the Questions. **Each** question carries **ten** marks.   (2Qx10M=20)

5. Derive the effect of the gyroscopic couple and centrifugal couple on a two wheeled vehicle when taking a turn (right) with the help of a neat diagram mentioning angle of heel and Forces.

6. Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. Draw configuration diagram and use analytical as well as Graphical method.

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END TERM FINAL EXAMINATION

Even Semester: 2018-19

Course Code: MEC 214

Course Name: Dynamics of Machines

Program & Sem: Mechanical 6th Sem

Date: 22 May 2019

Time: 3 Hours

Max Marks: 80

Weightage: 40%

Instructions:

(i)   Read the questions carefully and answer all questions.
(ii) Read the question properly and answer accordingly.
(iii) Question paper consists of 3 parts.
(iv) Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** question carries **one** marks.   (20Qx1M=20M)

1.
(i) 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

   The effect of hammer blow in a locomotive can be reduced by
(a) decreasing the speed
(b) using two or three pairs of wheels coupled together
(c) balancing whole of the reciprocating parts
(d) both (a) and (b)

(iii) The partial balancing means
(a) balancing partially the revolving masses
(b) balancing partially the reciprocating masses
(c) best balancing of engines
(d) all of the above

(iv) The height of a Watt's governor (in metres) in 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.

(v) A governor is said to be hunting, if the speed of the engine
(a) remains constant at the mean speed
(b) is above the mean speed

(*c*) is below the mean speed

(*d*) fluctuates continuously above and below the mean speed.

(vi) A disturbing mass *m*1 attached to a rotating shaft may be balanced by a single mass *m*2 attached in the same plane of rotation as that of *m*1 such that

(*a*) *m*1.*r*2 = *m*2.*r*1   (*b*) *m*1.*r*1 = *m*2.*r*2   (*c*) *m*1. *m*2 = *r*1.*r*2

(vii) The swaying couple is due to the

(*a*) primary unbalanced force   (*b*) secondary unbalanced force

(*c*) two cylinders of locomotive   (*d*) partial balancing

(viii) 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

(ix) A disc spinning on its axis at 20 rad/s will undergo precession when a torque 100 N-m is applied about an axis normal to it at an angular speed, if mass moment of inertia of the disc is the 1 kg-m^2

(a) 2 rad/s   (b) 5 rad/s   (c) 10 rad/s   (d) 20 rad/s

(x) When the sleeve of a Porter governor moves upwards, the governor speed

(*a*) increases   (*b*) decreases   (*c*) remains unaffected   (d) none of the above

(xi) A body is said to be in dynamic equilibrium when

(a) vector sum of all forces acting on a body is zero

(b) vector sum of the moments of all forces acting about any arbitrary point or axis is zero

(c) Both (a) and (b)

(d) none of the above

(xii) Which one is **not** the effects of partial balancing of locomotives?

(a) Variation in tractive force along the line of stroke   (b) Swaying couple

(c) Hammer blow   (d) none of the above

(xiii) Watt governor is

(a) pendulum type   (b) gravity controlled   (c) spring controlled   (d) both (a) and (b)

(xiv) Rate of change of momentum of a body is directly proportional to……………….

(xv) Net or effective force applied on the piston, along the line of stroke is known as…….

(xvi) The resultant unbalanced force due to the two cylinders along the line of stroke is known as……..

(xvii) The property of matter offering resistance to any change of its state of rest or of uniform motion in a straight line is known as………..

(xviii) …………is the net effort (force) applied at the crank pin perpendicular to the crank, which gives the required turning moment on the crankshaft.

(xix) The unbalanced force acting at a distance between the line of stroke of two cylinders, constitute a couple in the horizontal direction. The couple is known as………………

(xx) When the equilibrium speed is constant for all radii of rotation of the balls within the working range, the governor is said to be………………

Part B

Answer **all** the Questions. **Each** question carries **five** marks.   (6Qx5M=30M)

2. What is the function of a flywheel? How does it differ from that of a governor?

3. What do you mean by angular velocity of precission and axis of precission? Explain with the help of a neat diagram along with the gyroscopic planes.

4. Calculate the vertical height of a Watt governor when it rotates at 80 r.p.m. Also find the change in vertical height when its speed increases to 82 r.p.m.

5. Define sensitiveness and stability of a governor with concerned expressions.

6. Explain primary and secondary unbalanced forces of reciprocating masses with suitable expressions.

7. What do you understand by Hunting of a Governor? Explain.

Part C

Answer **all** the Questions. **Each** question carries **ten** marks.   (3Qx10M=30M)

8. 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.

9. A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has a radius of 60 mm. The masses at A and D have a radius of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine:

a) The magnitude of the masses at A and D

b) The distance between planes A and D

c) The angular position of the mass at D.

10. Derive an expression for the height in the case of a Porter governor.