



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : AUE-501

DYNAMICS OF MACHINE

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own
words as far as practicable.*

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) The ratio of maximum fluctuation of speed and mean speed is called
- a) Coefficient of Fluctuation of Energy
 - b) Coefficient of speed
 - c) Coefficient of fluctuation of speed
 - d) Coefficient of maximum fluctuation of energy.
- ii) A governor is said to be isochronous when equilibrium speed of all radii of rotation of the balls with in the working range
- a) is constant
 - b) varies uniformly
 - c) is not constant
 - d) all of these.

- iii) Static balancing involves balancing of
- a) forces
 - b) couples
 - c) forces as well as couples
 - d) masses.
- iv) The condition of isochronisms can be realized in a governor.
- a) Watt
 - b) Porter
 - c) Proell
 - d) Hartnell.
- v) Mean force exerted by governor on the sleeve for a given change of speed is known as
- a) Sensitiveness of governor
 - b) Effort of governor
 - c) Stability of governor
 - d) Hunting of governor.
- vi) Static balancing involves balancing of
- a) forces
 - b) couples
 - c) both (a) and (b)
 - d) masses.
- vii) A reduction in amplitude of successive oscillation indicates vibrations.
- a) free
 - b) force
 - c) damp
 - d) natural.
- viii) The frequency of damped vibrations is always the natural frequency.
- a) equal to
 - b) more than
 - c) less than
 - d) double.

CS/B.TECH/AUE/ODD SEM/SEM-5/AUE-501/2016-17

- ix) At certain speed, the rotating shaft tends to vibrate violently in the transverse direction, then speed is called
- Whirling speed
 - Critical speed
 - Whipping speed
 - All of these.
- x) A governor is said to be hunting if the speed of the governor
- remain constant at the mean speed
 - is above the mean speed
 - fluctuates continuously above and below the mean speed
 - is below the mean speed.

GROUP - B**(Short Answer Type Questions)**Answer any *three* of the following. $3 \times 5 = 15$

2. Calculate the change in vertical height of a watt governor when its speed
- increases from 50 r.p.m. to 51 r.p.m.
 - increases from 200 r.p.m. to 201 r.p.m.
3. The wheels of a bicycle are of diameter of 800 mm. The rider on this bicycle is travelling at a speed of 16 km/hr on a level road. Total mass of rider and cycle is 110 kg. A brake is applied at the rear wheel. The pressure applied on the brake is 100 N and COF is 0.6. Find out
- Distance travelled by the cycle after braking.
 - Number of turns on the wheel.

CS/B.TECH/AUE/ODD SEM/SEM-5/AUE-501/2016-17

4. Show that Porter Governor cannot be isochronous ?
5. Prove that the whirling speed for a rotating shaft is same as the natural frequency of transverse vibration but its unit is rps.
6. What do you mean by sensitiveness of a governor ? Define 'Hunting'.

GROUP - C**(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. a) A small connecting rod 220 mm long between centres, has a mass of 2 kg and moment of inertia of $2 \times 10^{-4} \text{ kg mm}^2$ about its centre of gravity. CG is located at a distance of 150 mm from the small end centre. Determine the dynamically two mass systems when one mass is located at the small end centre.

If the connecting rod is replaced by two masses located at the two centres, find the correction couple that must be applied for the complete dynamical equivalent system, when the angular acceleration of the connecting rod is 20000 rad/s^2 in clockwise direction.

- b) What are the conditions for dynamically equivalent system ? 12 + 3

8. a) The crank and the connecting rod of a vertical single cylinder gas engine running at 1800 rpm are 60 mm and 240 mm respectively. The diameter of the piston is 80 mm and the mass of the reciprocating parts is 1.2 kg. At a point during the power stroke when the piston has moved 20 mm from the top dead centre position, the pressure on the piston is 800 kN/m^2 . Determine (i) the net force on the piston, (ii) the thrust on the connecting rod, (iii) the thrust on the sides of cylinder walls and (iv) the engine speed at which the above values are zero.

b) Explain a turning moment diagram for a flywheel.

12 + 3

9. A machine is coupled to a two-stroke engine which produces a torque of $(800 + 180 \sin 3\theta) \text{ N.m}$, where θ is the crank angle. The mean engine speed is 400 rpm. The flywheel and the other rotating parts attached to the engine have a mass of 350 kg at a radius of gyration of 220 mm. Calculate

- the power of the engine
- the total fluctuation of speed of the flywheel when
 - the resisting torque is constant.
 - the resisting torque is $(800 + 80 \sin \theta) \text{ Nm}$.

8 + 7

10. a) Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed'.

b) A constant torque 4 kW motor drives a riveting machine. A flywheel of mass 140 kg and radius of gyration of 0.5 m is fitted to the riveting machine. Each riveting operation takes 1 second and requires 9000 Nm energy. If the speed of flywheel is 420 rpm before riveting, then find $E_1 = 9000$
 $E = 4 \times 10^8$

i) the fall in speed of flywheel after the riveting

ii) the number of rivets closed per hour.

c) The radius of gyration of a flywheel is 1 metre and fluctuation of speed is not to exceed 1% of the mean speed of the flywheel. If the mass of the flywheel is 3340 kg and steam engine develops 150 kW at 135 r.p.m. Then find

i) maximum fluctuation of energy

ii) co-efficient of fluctuation of energy. 2 + 7 + 6

11. a) A simple band brake is applied to a rotating drum of diameter 500 mm. The angle of lap of the band on the drum is 270° . One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If the coefficient of friction is 0.25 and a braking force of 90 N is applied at a distance of 600 mm from the fulcrum, find the braking torque when the drum rotates in (i) anti-clockwise direction, (ii) clockwise direction.

CS/B.TECH/AUE/ODD SEM/SEM-5/AUE-501/2016-17

b) A single cylinder reciprocating engine has the following data :

Speed of the engine is 150 r.p.m. Stroke is 350 mm, mass of the reciprocating parts are 40 kg, mass of revolving parts are 3 kg at crank radius. If 60% of the reciprocating parts and all the revolving parts are to be balanced, then find (i) the balanced mass required at radius 300 mm, and (ii) the unbalanced force when the crank has rotated 60° from the top dead centre.

9 + 6

<http://www.makaut.com>