OR	iii.	The crank and connecting rod of a petrol engine, running at 1000 r.p.m. are 100 mm and 200 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating parts is 10 kg. At a point during the power stroke, the pressure on the piston is 0.7 N/mm^2, when it has moved 10 mm from the inner dead centre. Determine: (a) Net load on the gudgeon pin (b) Thrust in the connecting rod (c) Reaction between the piston and cylinder (d) The engine speed at which the above values become zero	**6**	3	03	01 03	01
Q.4	i.	Define and explain the following terms related to governors- (a) Stability (b) Sensitiveness (c) Isochronism (d) Hunting	**2**	2	02	01 03	01
	ii.	Derive an expression for height of Watt governor.	**2**	2	02	01 03	01
	iii.	A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 10 kg and the mass of the central load on the sleeve is 50 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.	**6**	3	03	01 03	01
OR	iv.	The following particulars refer to a Proell governor with open arms: Length of all arms = 200 mm; distance of pivot of arms from the axis of rotation = 40 mm; length of extension of lower arms to which each ball is attached = 100 mm; mass of each ball = 10 kg and mass of the central load = 100 kg. If the radius of rotation of the balls is 180mm when the arms are inclined at an angle of 40° to the axis of rotation, find the equilibrium speed for the above configuration.	**6**	3	03	01 03	01

Total No. of Questions: 6 *Total No. of Printed Pages:5*

Enrollment No.....

Faculty of Engineering
End Sem Examination Dec 2024
ME3CO34 Dynamics of Machine

Programme: B.Tech. Branch/Specialisation: ME

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	**BL**	**CO**	**PO**	**PSO**
Q.1	i.	A pair of action and reaction forces acting on two connected bodies to behave in a particular manner depending upon the nature of connection are known as _____. (a) Applied forces (b) Constraint forces (c) Accelerating forces (d) Inertia forces	**1**	1	01	01 03	01
	ii.	If the lines of action of three or more forces intersect at a common point, it is known as the _____ point. (a) Equilibrium (b) Central (c) Permanent (d) Concurrency	**1**	1	01	01 03	01
	iii.	The ratio of the maximum fluctuation of speed to the mean speed is_____. (a) Fluctuation of speed (b) Maximum fluctuation of speed (c) Coefficient of fluctuation of speed (d) None of these	**1**	1	01	01 03	01
	iv.	If the mean radius of a rim-type flywheel is 1/4 , its stored energy is _____ of the original flywheel at the same speed. (a) 1/2 (b) 1/4 (c) 1/8 (d) 1/16	**1**	1	01	01 03	01
	v.	The height of a Watt's governor (in centimetres) is equal to- (a) 8.95/N^2 (b) 89.5/N^2 (c) 895/N^2 (d) 8950/N^2	**1**	1	01	01 03	01

vi.	A Hartnell governor is a- (a) Pendulum type governor (b) Spring loaded governor (c) Dead weight governor (d) Inertia governor	**1**	1	01	01 03	01		
vii.	For static balancing of rotating mass- (a) The net dynamic force acting on the shaft is equal to zero (b) The net couple due to the dynamic forces acting on the shaft is equal to zero (c) Both (a) and (b) (d) None of these	**1**	1	01	01 03	01		
viii.	For dynamic balancing of rotating mass (a) The net dynamic force acting on the shaft is equal to zero (b) The net couple due to the dynamic forces acting on the shaft is equal to zero (c) Both (a) and (b) (d) None of these	**1**	1	01	01 03	01		
ix.	In Rayleigh's method for finding natural frequency of the system. (a) The sum of kinetic and potential energy is zero (b) The sum of kinetic and potential energy is constant (c) Kinetic energy is zero (d) Max. kinetic energy is equal to max. potential energy	**1**	1	01	01 03	01		
x.	The causes of a vibration are in any vibrating body may be due to (a) Dry friction between two rubbing surfaces (b) Unbalance forces (c) External excitation forces (d) All of these	**1**	1	01	01 03	01		
Q.2 i.	Explain D'Alembert principle and write its application.	**2**	2	02	01 03	01		
ii.	Explain the condition for equilibrium of: (a) Two force member (b) Three force member (c) Two force and a torque member	**3**	2	02	01 03	01		

iii.	A slider crank mechanism with the following dimensions is acted upon by a force F= 2kN at B point gudgen pin. Crank OA= 100 mm, connecting rod AB= 450mm crank angle 120° from IDC. Determine the input torque on the link OA for the static equilibrium of the mechanism for the given configuration.	**5**	3	03	01 03	01		
OR iv.	The following data relate to a connecting rod of a reciprocating engine: Mass = 55 kg; Distance between bearing centres = 900mm; Diameter of small end bearing = 80 mm; Diameter of big end bearing = 100 mm; Time of oscillation when the connecting rod is suspended from small end = 1.85 s; Time of oscillation when the connecting rod is suspended from big end = 1.7 s. Determine: (a) The radius of gyration of the rod about an axis passing through the centre of gravity and perpendicular to the plane of oscillation (b) The moment of inertia of the rod about the same axis (c) The dynamically equivalent system for the connecting rod, constituted of two masses, one of which is situated at the small end centre.	**5**	3	03	01 03	01		
Q.3 i.	What is the basic function of a flywheel in an ICE? Derive an expression for the energy stored in a flywheel.	**4**	3	03	01 03	01		
ii.	The turning moment diagram for a petrol engine is drawn to the following scales turning moment, 1 mm = 10 N-m; crank angle, 1 mm = 1°. 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^2. 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.	**6**	3	03	01 03	01		

Q.5	i.	What is the basic difference between rotating and reciprocating mass balancing.	**3**	2	02	01 03	01
	ii.	A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.	**7**	4	04	01 03	01
OR	iii.	Analyse the following terms related to reciprocating balancing with related derivation. (a) Variation in tractive force (b) Swaying couple (c) Hammer blow	**7**	4	04	01 03	01

Q.6		Attempt any two:					
	i.	Explain vibration with an example. Also discuss about the basic elements of vibrating system with related diagram.	**5**	2	02	01 03	01
	ii.	Give the basic classification of vibration with related criteria.	**5**	2	02	01 03	01
	iii.	Derive natural frequency of spring mass system using by- (a) Energy method (b) Newton second law	**5**	2	02	01 03	01

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[5]

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Marking Scheme
ME3CO34 (T) Dynamics of Machine (T)

Q.1	i)	b) Constraint forces	**1**
	ii)	d) concurrency	**1**
	iii)	c) coefficient of fluctuation of speed	**1**
	iv)	d) 1/16	**1**
	v)	(a) $8.95/N^2$	**1**
	vi)	b) Spring loaded governor	**1**
	vii)	a) the net dynamic force acting on the shaft is equal to zero	**1**
	viii)	(c) both (a) and (b)	**1**
	ix)	(d) Max. kinetic energy is equal to max. potential energy	**1**
	x)	(d) All of the above	**1**
Q.2	i.	D'Alembert principle 1M Its application. 1M	**2**
	ii.	condition for equilibrium of: (a) Two force member 1M (b) Three force member 1M (c) Two force and a torque member 1M	**3**
	iii.	Configuration diagram 1M FBD 2M input torque on the link OA. 2M	**5**
OR	iv.	Diagram 1M 1.the radius of gyration of the 2M 2. the moment of inertia of the rod. 1M 3.the dynamically equivalent system for the connecting rod, constituted of two masses 1M	**5**
Q.3	i.	basic function of a flywheel in an ICE. 2M Derive an expression for the energy stored in a flywheel. 2M	**4**
	ii.	TMD 1M Formula used 2M Determine the coefficient of fluctuation of speed 3M	**5**
OR	iii.	Formula used 1M 1. Net load on the gudgeon pin, 1M 2. Thrust in the connecting rod, 1M 3. Reaction between the piston and cylinder 1M 4. The engine speed at which the above values become zero. 1M	**5**
Q.4	i.	1.Stability, 2.Sensitiveness, 3.Isochronism 4.Hunting. **0.5 Marks Each**	**2**
	ii.	Diagram 1M Derive an expression for height of watt governor. 1M	**2**
	iii.	Diagram 1M Formula used 1M Find the minimum and maximum speeds and range of speed of the governor. 4M	**6**
OR	iv.	Diagram 1M Formula used 1M find the equilibrium speed of the governor. 4M	**6**
Q.5	i.	Any 3 difference between rotating and reciprocating mass balancing. **1Marks Each**	**3**
	ii.	Configuration diagram front view 1M End View 1M Data table 1M Force polygon 1M Couple polygon1M find their magnitudes and angular positions. 2M	**7**
OR	iii.	Analyse the following terms related to reciprocating balancing with related derivation. 1M i)Variation in Tractive Force 2M ii) Swaying couple 2M iii) Hammer Blow 2M	**7**
Q.6			
	i.	Explain vibration with an example. 2M Also discuss about the basic elements of vibrating system with related diagram. 3M	**5**
	ii.	Any 5 basic classification of vibration with related criteria. **1Marks Each**	**5**
	iii.	Derive natural frequency of spring mass system using by-	**5**

P.T.O.

[2] [3]

(a) Energy method
(b) Newton second law
2.5 Marks Each

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