

--	--	--	--	--	--	--	--	--	--



## GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, December – 2020

(Fifth Semester)

## BMEPC 5030 - DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 2 hrs

Maximum: 50 Marks

**The figures in the right hand margin indicate marks.****PART – A: (Multiple Choice Questions)****(1 x 10 = 10 Marks)****Q.1. Answer ALL questions****[CO#] [PO#]**

- a. Acceleration of piston of a reciprocating engine is 1 1,2
- (i)  $r\omega^2\left(\sin\theta + \frac{\sin 2\theta}{n}\right)$  (ii)  $r\omega\left(\cos\theta + \frac{\cos 2\theta}{n}\right)$
- (iii)  $r\omega^2\left(\cos\theta + \frac{\cos 2\theta}{4n}\right)$  (iv)  $r\omega^2\left(\cos\theta + \frac{\cos 2\theta}{n}\right)$
- b. In a dynamically equivalent system, a uniform distributed mass is divided -- 1 1,2  
----- point masses
- (i) Two. (ii) Three.  
(iii) Four. (iv) Five.
- c. The maximum fluctuation energy is the 1 1,2
- (i) Ratio of maximum to minimum energies. (ii) Sum of maximum to minimum energies.  
(iii) Difference of maximum to minimum energies. (iv) Difference of maximum to minimum energies from mean energy.
- d. The magnitude of the gyroscopic couple applied to a disc of moment of inertia I, spinning with an angular velocity  $\omega$  and having angular velocity of precession  $\omega_p$  is 2 1,2,3
- (i)  $I^2\omega\omega_p$  (ii)  $I\omega^2\omega_p$   
(iii)  $I\omega\omega_p^2$  (iv)  $I\omega\omega_p$
- e. Which governor is spring loaded governor 2 1,2,3
- (i) Watt. (ii) Hartnell.  
(iii) Porter. (iv) Proell.
- f. The ratio of height of a porter governor to that of a Watt governor when the length 2 1,2,2
- (i)  $\frac{M+m}{m}$  (ii)  $\frac{M+m}{m}$   
(iii)  $\frac{M}{M+m}$  (iv)  $\frac{m}{M+m}$
- g. The efficiency of the screw jack depends on 3 1,2
- (i) Pitch of the threads. (ii) Load.  
(iii) Both pitch and load. (iv) neither pitch nor load
- h. Which of the following brakes is commonly used in motor cars 3 1,2
- (i) Band brake. (ii) Shoe brake.  
(iii) Band and block brake. (iv) Internal expanding shoe brake.

- |  |               |       |
|--|---------------|-------|
| i. Static balancing involves balancing of  | 4             | 1,2,3 |
| (i) forces   | (ii) Couples. |       |
| (iii) forces as well as couples  | (iv) Masses.  |       |
| j. A reduction in amplitude of successive oscillations indicate ----- vibrations | 4             | 1,2,3 |
| (i) free   | (ii) Forced.  |       |
| (iii) damped   | (iv) Natural. |       |

**PART – B: (Short Answer Questions)**

**(2 x 5 = 10 Marks)**

Q.2. Answer ALL questions

[CO#] [PO#]

- |  |   |       |
|--|---|-------|
| a. State D' Alembert's principle?                | 1 | 1,2   |
| b. Give the application of gyroscopic principle? | 2 | 1,2&3 |
| c. What is the function of Governor?             | 2 | 1,2&3 |
| d. What are the types of friction?               | 3 | 1,2   |
| e. Write the importance of balancing?            | 4 | 1,2&3 |

**PART – C: (Long Answer Questions)**

**(6 x 5 = 30 Marks)**

Answer ANY FIVE questions

Marks [CO#] [PO#]

- |  |     |   |      |
|--|-----|---|------|
| 3. A horizontal gas engine running at 210 rpm has a bore of 220 mm and a stroke of 440 mm. The connecting rod is 924 mm long and the reciprocating parts weight 20 kg. When the crank has turned through an angle of 30° from the inner dead centre, the gas pressure on the cover and the crank slides are 500 kN/m <sup>2</sup> and 60 kN/m <sup>2</sup> respectively. Diameter of the piston rod is 40 mm. Determine. | (6) | 1 | 1,2  |
| i) turning moment on the crankshaft,   |     |   |      |
| ii) thrust on the bearings,  |     |   |      |
| iii) acceleration of the flywheel which has a mass of 8 kg and radius of gyration of 600 mm while the power of the engine is 22 Kw.  |     |   |      |
| 4. The following data relate to the connecting rod of a reciprocating engine:  | (6) | 1 | 1,2  |
| Mass = 50 kg   |     |   |      |
| Distance between the bearing centres = 900 mm  |     |   |      |
| Diameter of the big end bearing = 100 mm   |     |   |      |
| Diameter of the small end bearing = 100 mm   |     |   |      |
| Time of oscillation when the connecting rod is suspended from  |     |   |      |
| Big end = 1.7 s  |     |   |      |
| Small end = 1.85 s   |     |   |      |
| Determine the  |     |   |      |
| (i) Radius of gyration k of the rod about an axis through centre of mass perpendicular to the plane of the oscillation.  |     |   |      |
| (ii) Moment inertia of the rod about the same axis, and  |     |   |      |
| (iii) Dynamically equivalent system of the connecting rod compressing two masses, one of at small end bearing centre.  |     |   |      |
| 5. A disc with radius of gyration of 60 mm and a mass of 4 kg is mounted centrally on a horizontal axle of 80 mm length between bearings. It spins about the axle  | (6) | 2 | 1,2& |

- at 800 rpm counter clockwise when viewed from the right – hand side bearing. The axle processes about a vertical axis at 50 rpm in the clockwise direction when viewed from above. Determine the resultant reaction at each bearing due to mass and the gyroscopic effect. &3
6. Each arm of a Porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at the minimum and maximum speeds are 120 mm and 160 mm respectively. The mass of the sleeve is 24 kg and each ball is 4 kg. Find the range of speed of the governor. Also determine the range of speed if the friction at the sleeve. (6) 2 1,2&&3
7. A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine 90 r.p.m., find the power absorbed in friction at the thrust block, assuming **1.** uniform pressure ; and **2.** Uniform wear. (6) 3 1,2
8. A single plate clutch transmits 25 kW at 900 rpm. The maximum pressure intensity between the plates is  $85 \text{ kN/m}^2$ . the outer diameter of the plate is 360 mm. both sides of the plate are effective and the coefficient of friction is 0.25. determine the (6) 4 1,2&&3
- (i) inner diameter of the plate,  
(ii) axial force to engage the clutch.
9. Three masses of 8 kg, 12 kg, and 15 kg attached at radial distances of 80 mm, 100 mm, and 60 mm respectively to a disc on a shaft are in complete balance. Determine angular positions of the masses of 12 kg, 15 kg relative to the 8 kg mass. (6) 4 1,2&&3
10. In a single –degree damped vibrating system; a suspended mass of 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. determine the (6)
- (i) stiffness of the spring,  
(ii) logarithmic decrement,  
(iii) damping factor, and  
(iv) damping coefficient.

--- End of Paper ---