SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code : Theory of Machines | Course & Branch: B.Tech - ME
Year & Sem: II-B.Tech & II-Sem | Regulation: R18

		UNIT-I (PRECESSION & TURNING MOMENT DIAGRAM)	
1	a	Explain the effect of Gyroscopic couple on a Naval ship during pitching.	5
	b	Explain the effect of gyroscopic couple on a Aeroplane.	5
2		Each paddle wheel of a steamer have a mass of 1600kg and a radius of gyration of 1.2meters.The steamer turns to port in a circle of 160meters radius at 24Km/hr.The speed of the paddle is 90rpm.Find the magnitude and effect of the gyroscopic couple acting on the steamer.	10
3		The rotor of a turbine yatch rotates at 1200rpm clockwise when viewed from stern. The rotor has a mass of 750 kg and radius of gyration of 250mm.Find the maximum gyroscopic couple transmitted to the hull when yacht pitches with a maximum angular velocity of 1 rad/s. What is the effect of this couple?	10
4		Define coefficient of fluctuation of speed and coefficient of fluctuation of energy.(ii)The radius of gyration of a fly wheel is 1meter and fluctuation of speed is not to exceed 1%of the mean speed of the flywheel. If the mass of the flywheel is 3340kg and the steamdevelops 150KW at 135rpm, then find 1.Maximum fluctuation of energy 2. Coefficient of fluctuation of energy .	10
5		A horizontal gas engine running at 210rpm has a bore of 220mm and a stroke of 440mm. The connecting rod is 924mm long the reciprocating parts weight 20kg.When the crank has turned through an angle of 30° from IDC, the gas pressure on the cover and the crank sidesare 500KN/m2 and 60KN/m2 respectively. Diameter of the piston rod is 40mm.Determine,1. Turning moment on the crank shaft 2.Thrust on bearing 3. Acceleration of the flywheel which has a mass of 8kg and radius of gyration of 600mm while the power of the engine is 22KW.	10
6		A vertical double acting steam engine has a cylinder 300mm diameter and 450mm stroke and runs at 200rpm.The reciprocating parts has a mass of 225kg and the piston rod is 50mm diameter.The connecting rod is 1.2m long. When the crank has turned 125°from IDC the steam pressure above the piston is 30KN/m2.calculate,(i)Crank-pin effort(ii)The effective turning moment on the crank shaft.	10
7		The turning moment diagram for a petrol engine is drawn to a scale of 1mm to 600N-m and the horizontal scale of 1mm to 1°.The turning moment repeat itself after every half revolution of the engine. The area above and below the mean torque line are 305, 710, 50,350,980and 275mm.The mass of rotating parts is 40kg at a radius of gyration of 140mm.Clculate the coefficient of fluctuation of speed if the mean speed is 1500rpm.	10
8		The torque delivered by a two stroke engine is represented by T= (1000+300sin2Θ-500cos2Θ) N-m where _ is the angle turned by the crank from the IDC.The engine speed is 250rpm.Themass of the flywheel is 400kg and radius of gyration400mm.Determine,(i)the power developed (ii)the total percentage fluctuation of speed (iii)the angular acceleration of flywheel when the crank has rotated through an angle of 60° from the IDC. (iv) The maximum angular acceleration and retardation of the flywheel.	10
9		A racing car weights 20 KN it has wheel base of 2m track width 1m and height ofcenter of gravity 300mm above the ground level & lies midway between the front and rear axel. The engine flywheel rotates at 3000 rpm clockwise, when viewed from the front view the	10

		moment of inertia of flywheel is 4 Kg-m2 & moment of inertia of each wheel is 3 Kgm2 .Find the reactions between the each wheels, the ground when the car takes the curve of 15m radius towards right at 30 Km/hr taking in to consideration the Gyroscopic and centrifugal effects. Each wheel radius is 400mm.	
10		A horizontal single acting steam engine has a cylinder 400mm diameter and 550mm stroke and runs at 180rpm.The reciprocating parts has a mass of 225kg and the piston rod is 50mm diameter.The connecting rod is 1.2m long. When the crank has turned 125°from IDC the steam pressure above the piston is 30KN/m2.calculate,(i)Crank-pin effort(ii)The effective turning moment on the crank shaft.	
		UNIT II (BRAKES & DYNAMOMETERS)	
1		A collar bearing internal and external diameter as 200 and 300 mm. maximum intensity pressure as 0.06 N/mm². the coefficient of frictional surface shaft and plate surfaces as 0.03 .determine power lost in to the shaft. Assuming uniform wear.shaft speed rotating with speed of 1200 rpm.	10
2		A pivot flat bearing internal and external diameter as 300 and 450mm. maximum intensity pressure as 0.075 N/mm².the first disc had three plates and second disc had two disc the coefficient of frictional surface shaft and plate surfaces as 0.02 .power absorbed by disc is 5kw. Assuming uniform wear. shaft rotating with speed of 580 rpm,then findout torque developed on the plate.	10
3		A cone pivot bearing had 400mm diameter. It is supported by the shaft with speed of 250 rpm. Cone angle as 120º Normal intensity pressure in to the shaft and face plate surface as 0.08 N/mm².power lost in to shaft was 4kw.determine total toque in to the plate. Consider shaft rotating with uniform wear.	10
4	a	Explain function of absorption type dynamometer	5
	b	Describe with sketches one form of torsion dynamometer and explain in detail the calculations involved in finding the power transmitted.	5
5	a	Describe with neat sketch the lope brake dynamometer	5
	b	Derive the expression for Uniform Pressure and uniform wear any one of the Bearing	5
6		In a vertical belt transmission dynamometer the diameter of the driving pulley rotating at 1500rpm is 80mm. The centre distance of the intermediate pulleys from the fulcrum is also 80mm each. The weighing pan on the lever is at a distance as 250mm. Find the power Transmitted when a mass of 20kg is required in the pan, including its own mass.	10
7		A single disc clutch internal and external diameter as 200 and 300 mm. maximum intensity pressure as 0.06 N/mm².the coefficient of frictional surface shaft and plate surfaces as 0.03 N/mm².determine power lost in to the shaft. Assuming uniform wear. shaft speed rotating with speed of 1200 rpm.	10
8		A multi clutch internal and external diameter as 300 and 450mm. maximum intensity pressure as 0.075 N/mm².the first disc had three plates and second disc had two disc the coefficient of frictional surface shaft and plate surfaces as 0.02 N/mm².power absorbed by disc is 5kw. Assuming uniform wear. shaft rotating with speed of 580 rpm. then find out torque developed on the plate.	10
9		A cone clutch had 400mm external diameter and 200mm internal diameter it is supported by the shaft with speed of 250 rpm. Semi angle as 50º Normal intensity pressure in to the shaft and face plate surface as 0.08 N/mm².power lost in to shaft was 4kw.determine total toque in to the plate. Consider shaft rotating with uniform wear.	10
10		In a horizontsl belt transmission dynamometer the diameter of the driving pulley rotating at 1800rpm is 90mm. The centre distance of the intermediate pulleys from the fulcrum is also 70mm each. The weighing pan on the lever is at a distance as 250mm. Find the power Transmitted when a mass of 30kg is required in the pan, including its own mass.	

		UNIT-III (GOVERNORS)	
1		A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and mass of the central load on the sleeve is 25kg.The radius of rotation of the ball is 150mm when governor is at maximum speed. Find the maximum and minimum speed and range of speed of the governor.	10
2		The length of the upper and lower arms of a porter governor are 200mm and 250mm respectively. Both the arms are pivoted on the axis of rotation. The central load is 150N, the weight of the each ball is 20N and the friction of the sleeve together with the resistance of the operating gear is equivalent to a force of 30N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40° taking friction in to account. Find the range of speed of the governor.	10
3		Calculate the rage of speed of a porter governor which has equal arms of each 200mm long and pivoted on the axis of rotation .The mass of each ball is 4kg and the central load of the sleeve is 20kg.The radius of rotation of the ball is 100mm when the governor being to lift and 130mm when the governor is at maximum speed.	10
4		A hartnell governor having a central sleeve spring and two right angled bell crank lever operates between 290rpm and 310rpm for a sleeve lift of 15mm. The sleeve and ball arms are 80mm and 120mm respectively. The levers are pivoted at 120mm from the governor axis and mass of the ball is 2.5kg.The ball arms are parallel at lowest equilibrium speed. Determine (i) load on the spring at maximum and minimum speeds and (ii) Stiffness of the spring.	10
5		A governor of hartnell type has equal balls of mass 3kg, set initially at a radius of 200mm.The arms of the bell crank lever are 110mm vertically and 150mm horizontally. Find (i) the initial compressive force on the spring at a radius of 200mm at240rpm and (ii) the stiffness of the spring required to permit a sleeve movement of 4mm on a fluctuation of 7.5 percent in the engine speed.	10
6		In a spring controlled governor, the controlling force curve is a straight line. When the balls are 400mm apart, the controlling force is 1200N and when 200mm apart, the controlling force is 450N.Determine the speed at which the governor runs when the balls are 250mm apart. When initial tension on the spring would be required for isochronisms and what would be the speed. Take mass of each ball to be 10kg.	10
7		Calculate the minimum speed of a proell governor, which has equal arms each of 200mm and are provided on the axis of rotation. The mass of each ball is 4kg and the central mass on the sleeve is 20kg.The extension arms of the lower links are each 60mm long and parallel to the axis when the minimum radius of the ball is 100mm.of load.	10
8		Calculate the minimum speed of a proell governor, which has equal arms each of 300mm and are provided on the axis of rotation. The mass of each ball is 5kg and the central mass on the sleeve is 25kg.The extension arms of the lower links are each 70mm long and parallel to the axis when the minimum radius of the ball is 120mm.of load.	10
9		Explain Hartung spring controlled governor. drive their expression and how is it varies from hartnell type ?	10
10		A harttung governor having a central sleeve spring and two right angled bell crank lever operates between 300rpm and 340rpm for a sleeve lift of 15mm. The sleeve and ball arms are 80mm and 120mm respectively. The levers are pivoted at 120mm from the governor axis and mass of the ball is 2.5kg.The ball arms are parallel at lowest equilibrium speed. Determine (i) load on the spring at maximum and minimum speeds and (ii) Stiffness of the spring.	
		UNIT-IV (BALANCING)	
1		A shaft is rotating at a uniform angular speed. Four masses M1, M2, and M3and M4 of	10

		magnitudes 300kg, 450kg, 360kg, 390kg respectively are attached rigidly to the shaft. The masses are rotating in the same plane. The corresponding radii of rotation are 200mm, 150mm, 250mm and 300mm respectively. The angle made by these masses with horizontal are 0°.45°, 120°and 255°respectively. Find,(i) the magnitude of balancing mass (ii) the position of balancing mass if its radius of rotation is 200mm.	
2		Four masses A, B, C, and D are completely balanced masses C and D makes angles of 90° and 195° respectively with B in the same sense. The rotating masses have the following properties: mA=25kg rA=150mm mB=40kg rB=200mm mC=35kg rC=100mm rD=180mm Planes B and C are 250mm apart. Determine (i) the mass A and its angular position (ii) the position of planes A and D.	10
3		A, B, C and D are four masses carried by a rotating shaft at radii 100mm,125mm,200mm and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the masses of B,C and D are 10kg,5kg and 4kgrespectively.Find the required mass A and relative angular setting of the four masses so that the shaft be in complete balance.	10
4		A four cylinder vertical engine has cranks 300mm long. The plane of rotation of the first, third and fourth cranks are 750mm,1050mm and 1650mm respectively from that of the second crank and their reciprocating masses are 10kg,400kg and 250kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular position of the cranks in order that the engine may be in complete balance.	10
5		Derive the following expression of effects of partial balancing in two cylinder locomotive engine (i) Variation of attractive force (ii) Swaying couple (iii) Hammer blow	10
6		Four masses M1, M2, M3, and M4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angle between successive masses45˚, 75˚,and135˚.Find the position and magnitude of balance mass required if its radius of rotation is 0.25m.	10
7		The data for three rotating masses are given below:- M1=4kg r1=75mm θ1=45 M2=3kg r2=85mm θ2=135 M3=2.5kg r3=50mm θ3=240 Determine the amount of counter mass at a radial distance of 65mm required for their static balance.	10
8		Four masses A, B, C, and D are completely balanced masses C and D makes angles of 90˚ and 195˚ respectively with B in the same sense. The rotatingmasses have the following properties: mA=25kg rA=150mm mB=40kg rB=200mm mC=35kg rC=100mm rD=180mm Planes B and C are 250mm apart. Determine (i) the mass A and its angular position (ii) the position of planes A and D.	10
9		A four cylinder vertical engine has cranks 150mm long. The plane of rotation of the first, second and fourth cranks are 400mm,200mm and 200mm respectively from that of the third crank and their reciprocating masses are 50kg,60kg and 50kg respectively. Find the mass of the reciprocating parts for the third cylinder and relative angular position of the cranks in order that the engine may be in complete balance.	10
10		A three cylinder vertical engine has cranks 300mm long. The plane of rotation of the first, third and fourth cranks are 750mm,1050mm and 1650mm respectively from that of the second crank and their reciprocating masses are 10kg,400kg and 250kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular position of the cranks in order that the engine may be in complete balance.	
		UNIT- V (VIBRATION)	
1		A vibrating system consists of a mass of 8kg,spring of stiffness 5.6N/m and dashpot of damping coefficient of 40N/m/s. Find,(i)Critical damping coefficient (ii) the damping factor (iii)the natural frequency of damped vibration (iv)the logarithmic decrement(v)the ratio of two consecutive amplitude (vi)the number of cycle after which the original amplitude is reduced to 20 percent.	10

2		In a single degree of damped vibration system a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine (i) the spring stiffness (ii) logarithmic decrement (iii) damping factor (iv) Damping coefficient.	10
3		Derive an expression for the natural frequency of the free longitudinal vibration by (i) Equilibrium method (ii) Energy method (iii) Rayleigh's method	10
4	a	Deduce the expression for the free longitudinal vibration in terms of spring stiffness, its inertia effect and suspended mass.	
	b	A spring mass system has spring stiffness 's'N/m and has a mass of 'm'kg.It has the natural frequency of vibration as 12Hz.An extra 2kg mass is coupled to 'm' and natural frequency reduces by 2Hz.Find the value of 's' and 'm'.	10
5		An instrument vibrates with a frequency of 1Hz when there is no damping. When the damping is provided, the frequency of damped vibration was observed to be 0.9Hz. Find, (i) damping factor (ii) logarithmic decrement.	10
6		Between a solid mass of 0kg and the floor are kept two slabs of isolates, natural rubber and felt, in series. The natural rubber slab has a stiffness of 3000N/m and equivalent viscous damping coefficient of 100 N-sec/m. The felt has a stiffness of 12000N/m and equivalent viscous damping coefficient of 330Nsec/ m. Determine un damped and the damped natural frequencies of the system in vertical direction.	10
7		A cantilever shaft 50mm diameter and 300mm long has a disc of mass 100kg at its free end. The young's modulus for the shaft material is 200GN/m2.SDetermine the frequency of longitudinal and transverse vibration of the shaft.	10
8		The barrel of a large gun recoils against a spring on firing. At the end of the firing, a dashpot is engaged that allows the barrel to return to its original position in minimum time without oscillation. Gun barrel mass is 400kg and initial velocity of recoils 1m.Determine spring stuffiness and critical damping coefficient of dashpot.	10
9		A steel shaft 100mm in diameter is loaded and support in shaft bearing 0.4m apart. The shaft carries three loads: first mass 12kg at the centre, second mass 10kg at a distance 0.12m from the left bearing and third mass of 7kg at a distance 0.09m from the right bearing. Find the value of the critical speed by using Dunkerley's method. E=210GN/m^2.	10
10		An two degree of damped vibration system a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine (i) the spring stiffness (ii) logarithmic decrement (iii) damping factor (iv) Damping coefficient.	

TWO MARK QUESTIONS

UNIT 1

1. Explain following terms i) Piston Effort ii) Crank effort iii) Crank pin Effort

2. Define the Gyroscopic torque

3. Define Co efficient of fluctuation of energy.

4. Define Co efficient of fluctuation of Speed.

5. Explain the Gyroscopic couple on rolling of ship? Why?

6. What is the function of fly wheel.

7. What are the applications of turning moment diagram?

8. Define active gyroscopic couple and reactive gyroscopic couple.

9. Chart out the effect of gyroscopic couple in aero plane.

10. Draw a turning moment for single cylinder double acting steam engine.

UNIT-2

1. How is rolling friction different from sliding friction?

2. Write different types bearings

3. Distinguish between a brake and a dynamometer.

4. Write the principle of Dynamometer

5. Define centrifugal clutch

6. Draw a schematic sketch of Prony brake dynamometer.

7. Define coefficient of friction

8. Define torque

9. Differentiate multi disc clutch and cone clutch.

10. What is the required property for braking matrial

UNIT-3

1. How the governors are classified?

2. What is meant by Sensitiveness of governors?

3. Distinguish between a Governor and a flywheel.

4. What is the effect of friction on the governor?

5. What is meant by isochronous condition in Governors?

6. Why too sensitive governors are not useful?

7. What is the difference between porter and proell governors

8. With neat sketch lable the parts of hartung governor

9. What is mean by hunting of governor

10. Differentiate flywheel and governor

UNIT-4

1. What is balancing of rotating masses?

2. Why rotating masses are to be dynamically balanced?

3. Define direct and reverse cranks

4. What are the different types of balancing machines?

5. Define Swaying couple?

6. Define hammer blow.

7. What is mean by partial balancing of single cylinder engine?

8. How different masses rotating in different planes are balanced?

9. Define static and dynamic balancing

10. List out the assumptions for complete balancing of reciprocating masses.

UNIT-5

1. What are the types of Vibrations?

2. What are the cause of critical speed? Or why critical speed encountered?

3. Distinguish between a traverse and torsional vibration.

4. Distinguished the critical damping and large damping

5. Define resonance.

6. Define logarithmic decrement.

7. Define whirling of shaft.

8. Explain transmissibility.

9. A vibrating system consist of a mass of 200kg, a spring of stiffness 80N/mm and a damper with damping coeff of 800 N/ms. Determine the frequency of vibration of he system.

10.define frequency in forced vibration.

Prepared by V.KARTHIKEYAN