J.J COLLEGE OF ENGINEERING AND TECHNOLOGY

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SOWDAMBIKAA GROUP OF INSTITUTIONS

ESTD. 1994

DEPARTMENT OF AERONAUTICAL ENGINEERING

AE3491 – MECHANICS OF MACHINES

QUESTION BANK

R-2021

INSTITUTE VISION & MISSION

VISION:

To become a globally recognized "Centre of Academic Excellence" providing Quality Education to all students.

MISSION:

To provide Quality Education in the fields of Engineering, Management, Information, Technology and other Engineering areas.

DEPARTMENT VISION & MISSION

VISION:

To prepare technically skilled and competent intellectual professional graduates to meet the challenges in the Aerospace industry.

MISSION:

M1: To produce technologically competent graduates to be front-runner in their profession.

M2: To provide state-of-the-art facilities and laboratories so as to enhance excellence in teaching and learning process.

M3: To provide need-based quality training programmes in the field of the Aerospace industry.

M4: Enhance the students' sound knowledge in the latest technologies by organizing technical programs and encouraging students to make them present papers and participate in technical events.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To employ comprehensive knowledge in Aeronautical Engineering and analytical skills to work towards solving complex problems to excel in the professional career.
PEO2	To design, analyze and produce cutting edge engineering solutions by employing modern techniques and adhering to moral values for sustainable development.
PEO3	To assume global careers and leadership responsibilities through consistent learning with idealistic managerial practices.

PROGRAM OUTCOMES (POs)

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions Using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including the design of experiments, Analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply to reason in formed by the contextual Knowledge to assess societal, health, safety, legal and cultural issues and the Consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8	**Ethics:** Apply ethical principles and commit to professional ethics and Responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a Member or leader in Diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able To comprehend And write effective reports and design documentation, make effective presentations, and give and Receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply These to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to Engage in in dependent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	To gather data using modern tools and apply design techniques to develop solutions for challenges in the domain of Aerodynamics, Propulsion, Aircraft Structures and Aircraft Maintenance with professional ethics.
PSO2	To function as engineering solution providers or entrepreneurs, who are able to manage, innovate, communicate, train and lead a team for continuous improvement.
PSO3	Graduate will be able to work as a team member which will be a main requirement in industry or research organisation or in any business enterprise. This will pave the way for successful career for the graduate and also play a role for the success of the organisation in which the graduate is employed.

AE3491 MECHANICS OF MACHINES L T P C
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COURSE OBJECTIVES:

This course will familiarize the students with the Aircraft engine maintenance procedure and practice, acquire knowledge of basics of Aeronautics and engine components, learn the concepts of Piston engines, aware of aircraft propellers and repair and aircraft jet engines and repair.

UNIT – I KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS 9

Mechanisms – Terminology and definitions – kinematics inversions and analysis of 4 bar and slide crank chain – velocity and acceleration polygons – cams – classifications – displacement diagrams - layout of plate cam profiles.

UNIT – II TOOTHED GEARING AND GEAR TRAINS 9

Gear terminology – law of toothed gearing – involute gearing – Gear tooth action - Interference and undercutting – gear trains – parallel axis gear trains – epicyclic gear trains.

UNIT – III FRICTION ASPECTS IN MACHINE COMPONENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt drives – Friction aspects in brakes.

UNIT – IV STATIC AND DYNAMIC FORCE ANALYSIS 9

Applied and Constrained Forces – Free body diagrams – Static equilibrium conditions – Static Force analysis in simple mechanisms – Dynamic Force Analysis in simple machine members – Inertia Forces and Inertia Torque – D'Alembert's principle.

UNIT – V BALANCING OF ROTATING MASSES AND VIBRATION 9

Static and Dynamic balancing – Balancing of revolving masses – Balancing machines – Free vibrations – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Forced vibration – harmonic Forcing – Vibration isolation.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

On completion of this course, the students expected to be able to:	
CO1	Design the linkages and the cam mechanisms for specified output motions.
CO2	Determine the gear parameters of toothed gearing and speeds of gear trains in various applications.
CO3	Evaluate the frictional torque in screw threads, clutches, brakes and belt drives.
CO4	Determine the forces on members of mechanisms during static and dynamic equilibrium conditions.
CO5	Determine the balancing masses on rotating machineries and the natural frequencies of free and forced vibratory systems

CO's – PO's & PSO's MAPPING

Correlation of COs with POs / PSOs															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2.5	2	-	1	-	-	-	-	3	3	1	1
CO2	3	3	3	3	2	-	1	-	-	-	1	3	3	1	1
CO3	3	2.5	2.5	2.5	2	2	1	-	-	-	1	3	3	1	1
CO4	3	3	3	2.5	2	-	1	-	-	-	1	3	3	1	1
CO5	3	3	3	3	2	2	1	-	-	-	1	3	3	1	1
AVG	**3**	**2.7**	**2.9**	**2.7**	**2**	**0.8**	**1**	**-**	**-**	**-**	**0.8**	**3**	**3**	**1**	**1**
3 – High; 2 – Medium; 1 – Low; - – No Correlation															

TEXT BOOK:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.

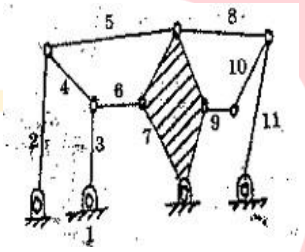
REFERENCE BOOKS:

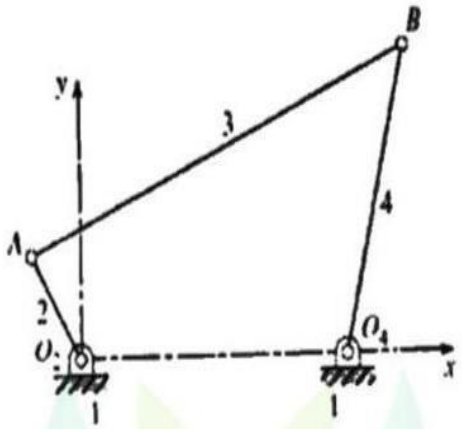
1. Cleghorn. W. L., Nikolai Dechev, "Mechanisms of Machines", Oxford University Press, 2015.
2. Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd.,2006.
3. Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 2014.
4. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2009.
5. Thomas Bevan, "The Theory of Machines", Pearson Education Ltd., 2010

UNIT– I

KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Differentiate between Machine and Structure.	CO1	Understand	Low
2	Classify the constrained motion.	CO1	Analyze	Medium
3	Write a short note on completed and incomplete constrains in lower and higher pairs, depict your answer with neat sketches.	CO1	Understand	Low
4	Classify kinematics pair based on nature of contact.	CO1	Analyze	Medium
5	When does a linkage become mechanism?	CO1	Understand	Low
6	Define Grubler's criteria for the mechanism.	CO1	Remember	Low
7	Name any two inversions of the four- bar mechanism.	CO1	Remember	Low
8	Write the different types of kinematic pairs based on the relative motion between them.	CO1	Understand	Low
9	What are the different types of cams?	CO1	Understand	Low
10	What are the different types of followers?	CO1	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain how the Whitworth quick return mechanism and Crank and Slotted lever mechanism are different from each other.	CO1	Understand	Medium
2	Explain with new sketch, kinematic inversions of four bar chain.	CO1	Understand	Medium
3	Draw with neat sketch, explain the crank and slotted lever quick return mechanism.	CO1	Create	High
4	What is a kinematic inversion? Discuss ant three applications of inversions of slider crank mechanism with suitable sketches.	CO1	Understand	Medium
5	State and brief the Kutzbach criterion for planar mechanisms and using this criterion, determine the arrangement shown as structure or Constrained mechanism or an unconstrained mechanism. 	CO1	Create	High
6	For the four-bar linkage in the arbitrary posture shown, derive the expression for the relationship between the angular velocity of the input link 2 and the angular velocities of the coupler link 3 and the output link 4.	CO1	Create	High

				
7	i) Explain any three inversions of single slider crank chain mechanism. ii) In a single slider crank chain mechanism, the crank and connecting rod lengths of an engine are 125 mm and 500 mm respectively. The mass of the connecting is 60 kg and its center of gravity is 275 mm from the cross-head pin center, the radius of gyration about center of gravity being 150 mm. if the engine speed is r.p.m for crank position of 45^0 from the inner dead center, determine, velocity of the piston angular velocity of the connecting rod.	CO1	Create	High
8	A cam is rotating clock wise at a uniform speed of 1000 rpm is required to give a roller follower the motion defined below: i) Follower to move outwards though 50 mm during 120^0 of cam rotation.	CO1	Create	High

	ii) Follower to dwell for next 60^0 of cam rotation. iii) Follower to return to its starting position during next 90^0 of cam rotation. iv) Follower to dwell for the rest of the cam rotation. The minimum radius of the cam is 50 mm and the diameter of the roller is 10 mm. The line of stroke of the follower is offset by 20 mm from the axis of the cam shaft. If the displacement of the follower takes place uniform and equal acceleration and retardation on both the outward and return stroke, draw the profile of the cam and find the maximum velocity and acceleration during the outstroke and return stroke.			
9	A cam is rotating clock wise at a constant speed of 1200 rpm is required to give a roller follower the motion defined below: i) Follower to move outwards though 45 mm during 120^0 of cam rotation. ii) Follower to dwell for next 60^0 of cam rotation. iii) Follower to return to its starting position during next 120^0 of cam rotation. iv) Follower to dwell for the rest of the cam rotation. The minimum radius of the cam is 30 mm and the diameter of the roller is 20 mm. The line of stroke of the follower is offset by 15 mm from the axis of the cam shaft. If	CO1	Create	High

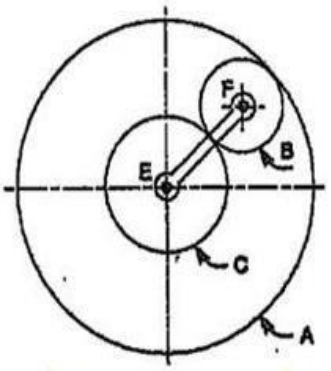
	the displacement of the follower takes place simple harmonic motion. Draw the profile of the cam.			
10	The following data relate to a cam profile in which the follower is a knife edge follower and moves with SHM during the ascent and decent. Minimum radius of cam is 25 mm, lift is 30 mm, angle of ascent is 120°, angle of descent 100°, angle of dwell between ascent and descent is 80°, speed of cam is 200 rpm. Draw profile of the cam and determine the maximum velocity and maximum acceleration during out stroke and the return stroke.	CO1	Create	High

UNIT – II

TOOTHED GEARING AND GEAR TRAINS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Define the term diametral pitch.	CO2	Remember	Low
2	What is interference and undercutting in gear?	CO2	Understand	Low
3	How interference can be prevented in gears?	CO2	Remember	Low
4	Define velocity ratio in compound train of wheels.	CO2	Remember	Low
5	State the fundamental Law of Toothed Gearing.	CO2	Remember	Low
6	What do you by undercutting in gears?	CO2	Understand	Low
7	Distinguish cycloid and involute profiles of gear tooth.	CO2	Analyze	High
8	What do you mean by spiral gears and hypoid gears?	CO2	Understand	Low
9	Write the advantages of cycloidal gears.	CO2	Understand	Low
10	Define module of gears and its relation to circular pitch.	CO2	Remember	Low

PART–B				
Q.No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Illustrate the interference and undercutting of spur gears.	CO2	Analyze	High
2	Differentiate between involute and cycloidal tooth profiles of the gears.	CO2	Understand	Medium
3	Describe the procedure of the law of tooth gearing.	CO2	Understand	Medium
4	A pair of involute spur gear with 160 pressure angle and pitch of module 6 mm is in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 rpm. When the gear ratio is 1.75, find in order that the interference is just avoided; i) The addendem on pinion and gear wheel. ii) The length of path of contact. iii) The maximum velocity of sliding of teeth on either side of the pitch point.	CO2	Create	High
5	Classify the gear trains.	CO2	Analyze	Medium
6	A pair gears having 40 and 20 teeth respectively, are rotating in mesh, the speed of smaller being 2000rpm. Determine the velocity of sliding between the gear teeth faces at point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 200 involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.	CO2	Create	High

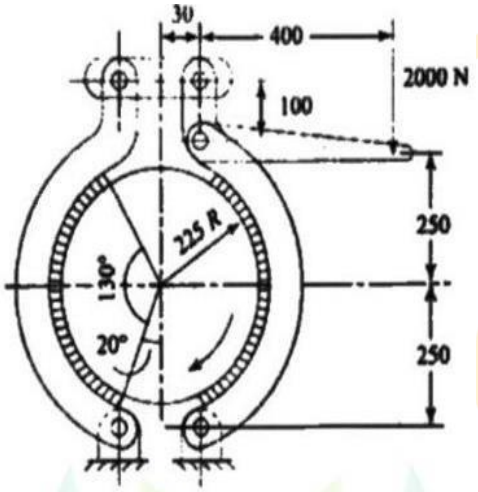
7	An epicycle gear consists of three gears A, B and C as shown. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the center of A at 18rpm. If the gear A is fixed, determine the speed of gear B and C. 	CO2	Create	High
8	A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 rpm. Determine: Sliding velocities at engagement and at disengagement of pair of a teeth and Contact ratio.	CO2	Create	High

UNIT – III

FRICTION ASPECTS IN MACHINE COMPONENTS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What is centrifugal tension? Write its relation with the mass per unit length of the belt and velocity of the belt.	CO3	Understand	Low
2	What is meant by a self-energizing brake?	CO3	Understand	Low
3	Define coefficient of friction angle of repose with respect to screw threads.	CO3	Remember	Low
4	Write the expression for torque transmitted by a single plate clutch with both sides effective at uniform wear condition.	CO3	Remember	Low
5	Define film friction.	CO3	Remember	Low
6	Define laws of friction.	CO3	Remember	Low
7	What are the disadvantages of V-belt drive over flat belt?	CO3	Understand	Low
8	What are the advantages of using friction clutches?	CO3	Understand	Low
9	Define slip and creep in a belt drive.	CO3	Remember	Low
10	Define lead and pitch of a screw thread.	CO3	Remember	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Determine the width of a 9.75 mm thick leather belt required to transmit 25 kW from a motor running at 900 r.p.m. The diameter of the driving pulley of the motor is 300 mm. The driven pulley runs at 300 r.p.m. and the distance between the centre of two pulleys is 3 metres. The density of the leather is 1000 kg/m3. The maximum allowable stress in the leather is 2.5MPa. The coefficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt.	CO3	Create	High
2	A vertical screw with single start square threads of 50 mm mean diameter and 12.5 mm pitch is raised against a load of 10 kN by means of a hand wheel, the boss of which is threaded to act as a nut. The axial load is taken up by a thrust collar which supports the wheel boss and has a mean diameter of 60 mm. The coefficient of friction is 0.15 for the screw and 0.18 for the collar. If the tangential force applied by each hand to the wheel is 100 N, find suitable diameter of the hand wheel.	CO3	Create	High
3	1.Derive the expression of screw threads with a neat sketch. 2.Discuss the disc and multi-plate clutch with a diagram.	CO3	Create	High

4	The bake shown in figure requires an actuating force of 2000 N at end of the lever. Coefficient of friction is 0.3 and maximum pressure intensity = 1 MPa. Determine the width of the shoe and the breaking capacity. 	CO3	Create	High
5	An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 m apart and transmit 4 kW from the smaller pulley that rotates at 300 rpm. Coefficient friction between the belt and the pulley is 0.3 and the safe working tension 10N per mm width. Determine: (i) Minimum width of the belt, (ii)Initial belt tension and (iii)Length of the belt required.	CO3	Create	High
6	A Pulley used to transmit power with rope drive has diameter 3 m and has 15 grooves of 45°. The angle of contact is 160° and the coefficient of friction between ropes and the groove sides are 0.3.	CO3	Create	High

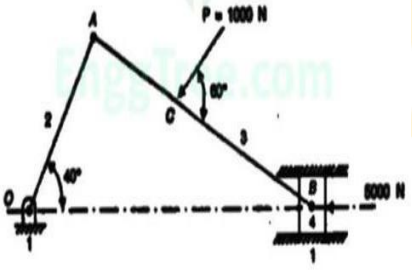
	The maximum possible tension in the ropes is 1000 N and the mass of the rope is1.5 kg per meter length. What is the speed of the pulley in rpm and the power transmitted if the condition of maximum power exists?			
7	An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 m apart and transmit 4 kW from the smaller pulley that rotates at 300 rpm. Coefficient friction between the belt and the pulley is 0.3 and the safe working tension 10N per mm width. Determine: (i) Minimum width of the belt (ii) Initial belt tension and (iii) Length of the belt required.	CO3	Create	High
8	A flat belt, 8 mm thick and 100 mm wide transmit power between two pulleys, running at 1600 m/min. The mass of the belt is 0.9 kg/m length. The angle of lap in the smaller pulley is 165° and the coefficient of friction between the belt and pulley is 0.3 If the maximum permissible stress in the belt is 2 MN/m2 Find (i) Maximum power transmitted and (ii) The Initial tension in the belt.	CO3	Create	High

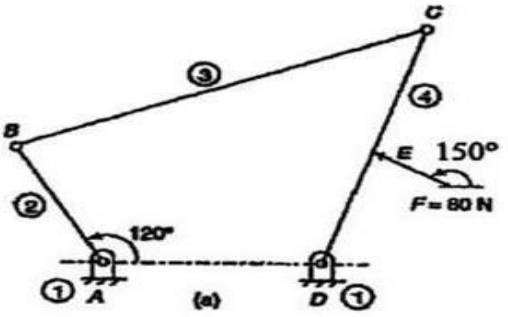
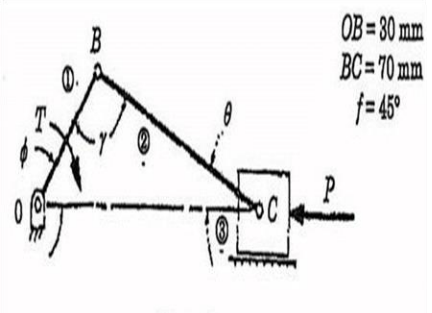
9	A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100 kW at 2400 rpm. and maximum torque 500 N-m. The outer radius of friction plate is 25% more than the inner radius. The intensity of pressure between the plate not to exceed 0.07N/mm2. The coefficient of friction may be assumed equal to 0.3. The helical springs required by this clutch to provide axial force necessary to engage the clutch are eight. If each spring has stiffness = 40N/mm, determine the initial compression in the springs and dimensions the friction plate.	CO3	Create	High

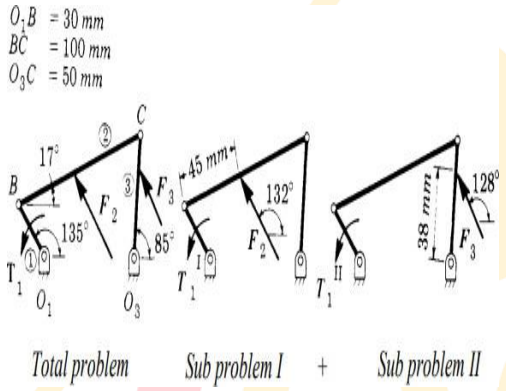
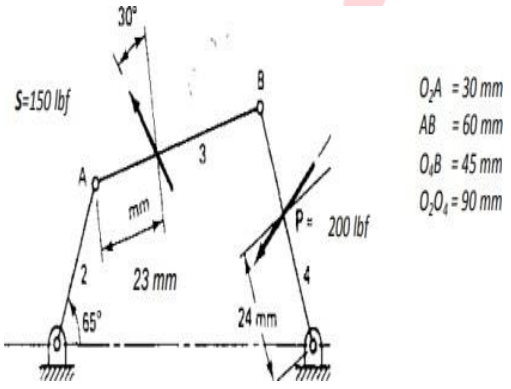
UNIT – IV

STATIC AND DYNAMIC FORCE ANALYSIS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Give a brief note on constrained forces.	CO4	Understand	Low
2	State the D'Alembert's principle.	CO4	Remember	Low
3	What is applied and constrained forces?	CO4	Understand	Low
4	With suitable example, explain the concept of inertia torque.	CO4	Understand	Low
5	What are the conditions for a body to be in static and dynamic equilibrium?	CO4	Understand	Low
6	Define static force analysis.	CO4	Remember	Low
7	Distinguish between space diagram and free body diagram.	CO4	Analyze	High
8	Give any three advantages of free body diagram.	CO4	Understand	Low
9	When will the two-force member is in equilibrium?	CO4	Understand	Low
10	Which law helps to measure a force quantitatively?	CO4	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Determine the torque required to be applied at the crank shaft of a slider crank mechanism to bring it in equilibrium. The slider is subjected to a horizontal force of 5000 N and a force of magnitude 1000 N is applied on the connecting rod as shown. The dimensions of various links are as follows: QA=250mm, AB=750mm and AC= 250 mm, <BOA= 40^0 	CO4	Create	High
2	In a slider crank mechanism, the length of stroke is 120 mm and connecting road is 250 mm long. When the crank rotates at 2000 rpm and has travelled 60^0 from dead center, find; a) Displacement of piston. b) Velocity and acceleration of the piston. c)Angular velocity and acceleration of connecting rod.	CO4	Create	High

3	A four-link mechanism with the following dimensions is acted upon by a force of 80N at an angle of 150° on link DC, as they are AD=50mm, AB = 40mm, BC = 100mm, DC = 75mm, DE = 35mm. (ii) Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. 	CO4	Create	High
4	Static-force analysis of slider crank mechanism is discussed. Consider the slider crank linkage shown as they are representing a compressor, which is operating at low speed that inertia effects are negligible. The dimensions are OB = 30mm and BC = 70 mm, we wish to find the required crank shaft torque T and the bearing forces for a total gas pressure force P= 40 N at the instant when the crank angle is 45^0. 	CO4	Create	High
5	Explain the superposition theorem as applicable to a system of forces acting on a mechanism.	CO4	Understand	Medium

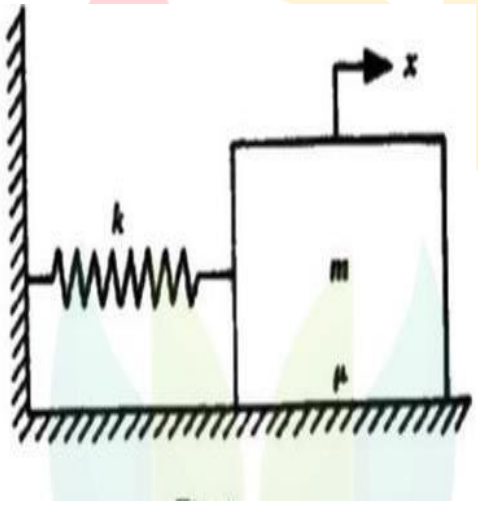
6	Derive the expression of inertia of the connecting rod with the diagram.	CO4	Create	High
7	Illustrate the conditions for a body to be in equilibrium under the action of two forces, three forces and a torque.	CO4	Analyze	High
8	Derive the torque expression for the turning moment on the crank shaft.  	CO4	Create	High
9	The four-bar mechanism as they have one external force P = 200 Ibf and one inertia force S = 150 Ibf acting on it. The system is in dynamic equilibrium as a result of torque T_2 applied to link 2. Find T_2 and the pin forces. (a) Use the graphical method based on free-body diagrams.  	CO4	Create	High

UNIT – V

BALANCING OF ROTATING MASSES AND VIBRATION

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What do you understand by damping ratio?	CO5	Understand	Low
2	Writethe equilibrium equations for (a) Static balancing (b) Dynamic balancing.	CO5	Understand	Low
3	What is damped vibration?	CO5	Understand	Low
4	What is the difference between free and forced vibration?	CO5	Understand	Low
5	Why balancing is necessary of rotating parts necessary for high-speed engines?	CO5	Understand	Low
6	What is the meaning of vibration isolation?	CO5	Understand	Low
7	Write the necessity of balancing.	CO5	Understand	Low
8	List the applications of damper.	CO5	Remember	Low
9	What is forced vibration?	CO5	Understand	Low
10	What is harmonic forcing?	CO5	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	A shaft carries four masses A, B, C and 0 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 0 120°. 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 0 is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.	CO5	Create	High
2	A body of mass 15 kg is suspended from a spring which deflects 12 mm under the weight of the mass. Calculate the frequency of free vibrations. Determine the frequency of the free vibration. What is the viscous damping force needed to make the motion a periodic at a speed of 1mm/s? If, when damped to this extent, a disturbing force having a maximum value of 100 N and vibrating at 6 Hz is made to act on the body, determine the amplitude of the ultimate motion.	CO5	Create	High

3	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.	CO5	Create	High
4	A block of mass 1 kg moves over a flat surface, coefficient of friction being 0.3. A spring of stiffness 150N/m connects the block to a wall as they are the block is pulled through a distance of 50mm away from the wall and is released with a velocity of 0.6m/s towards the wall. Find out the period for which the block will oscillate before coming to rest and also the position of the block when it comes to rest. 	CO5	Create	High

5	A rotating shaft carries four unbalanced mass 18kg, 14kg, 16kg and 12kg at radii 50mm, 60mm, 70mm and 60mm respectively. The second, third and fourth mass revolve in planes, 80mm, 160mm, 280mm respectively from the first mass and angularly at 600, 1350 and 2700 respectively measured clock wise from the first mass looking from the end of the shaft. The shaft dynamically balanced by adding two masses at radii 50mm and first mass revolving in mid-way between first and second and second mass revolving in mid-way between third and fourth. Determine the angular position and magnitude of the balance mass required.	CO5	Create	High

THANK YOU

ALL THE BEST