SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK

VI SEMESTER - MDE

1910603 – BIOMECHANICS

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Prepared by

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SUBJECT : 1910603 BIOMECHANICS

SEM / YEAR : VI / III

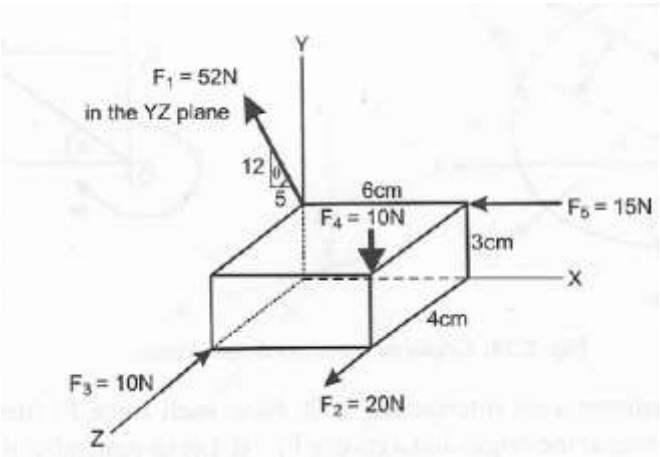
UNIT I – INTRODUCTION TO MECHANICS

Introduction – Scalars and vectors, Statics – Force types, Resolution and composition of forces, Moments of force and couple, Resultant force determination, parallel forces in space, equilibrium of coplanar forces, Dynamics, Basic principles – Linear motion, Newton's laws of motion, Impulse and Momentum, Work and Energy Kinetics – Velocity and acceleration, Kinematics – Link segment models, Force transducers, Force plates, Introduction to Constitutive equations – Constitutive equations of Nonviscous fluid, Newtonian Viscous fluid and Hookean Elastic solid

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Classify the types of forces. State its causes.	CO1	BTL 1	Remembering
2.	Why do we need constitutive equation?	CO1	BTL 1	Remembering
3.	List the important divisions of dynamics.	CO1	BTL 1	Remembering
4.	Define concurrent and non-concurrent forces.	CO1	BTL 1	Remembering
5.	Outline the concept of linear motion.	CO1	BTL 2	Understanding
6.	Differentiate kinetics and kinematics.	CO1	BTL 2	Understanding
7.	Point out the applications of biomechanics.	CO1	BTL 1	Remembering
8.	Name some examples of scalar and vector quantity.	CO1	BTL 1	Remembering
9.	State the conditions of equilibrium.	CO1	BTL 1	Remembering
10.	Interpret the three Newtons' laws of motion.	CO1	BTL 2	Understanding
11.	Write scalar and vector quantity in terms of biomechanics.	CO1	BTL 2	Understanding
12.	What is meant by velocity and acceleration?	CO1	BTL 1	Remembering
13.	Outline the importance of work, power and energy.	CO1	BTL 2	Understanding
14.	Compare stress and strain.	CO1	BTL 2	Understanding
15.	Compute the force acting on a body of mass 1.0 kg is falling with an acceleration of $10 m/s^2$.	CO1	BTL 2	Understanding
16.	Illustrate the meaning of center of gravity.	CO1	BTL 2	Understanding
17.	Distinguish between resolution and composition of forces.	CO1	BTL 2	Understanding
18.	Identify and state the law used in Hookean elastic solid.	CO1	BTL 2	Understanding

19.	Mention the parameters required to characterize the force.	CO1	BTL 1	Remembering
20.	A 200N force accelerates the scooter at 3.0 m/s^2. Find the mass of scooter.	CO1	BTL 1	Remembering
21.	Examine the moment of force for r = 3j and the force F= 20 kN.	CO1	BTL 2	Understanding
22.	Calculate the resultant of the Mentionn forces F_1= 48j +20k N, F_2 = 20 k N , F_3 = -10 k N, F_4 = -10j N, F_5= -15i N.	CO1	BTL 2	Understanding
23.	A soccer player starts at rest and accelerates forward, reaching a velocity of 8.00 m/s in 2.50 s. Analyze and find the acceleration.	CO1	BTL 1	Remembering
24.	Determine the amount of work is done on the lawn mower by the person when he exerts a constant force of 75.0 N at an angle 35° below the horizontal and pushes the mower 25.0 m on level ground.	CO1	BTL 2	Understanding
	PART B			
1.	What is biomechanics? Explain the different forces that acts on the body. (13)	CO1	BTL 4	Analyzing
2.	Illustrate the following in detail. (i) Scalar quantity. (6) (ii) Vector quantity. (7)	CO1	BTL 4	Analyzing
3.	Explain Newtons law and Mention necessary example relating to the physiological system. (13)	CO1	BTL 3	Applying
4.	Elaborate in detail about the resolution and composition of forces. (13)	CO1	BTL 3	Applying
5.	Express the velocity and acceleration with suitable diagram. (13)	CO1	BTL 3	Applying
6.	Write briefly on vector method for resultant force determination. (13)	CO1	BTL 4	Analyzing
7.	Derive the constitutive equations of non-viscous fluid. (13)	CO1	BTL 4	Analyzing
8.	Outline the motion of viscous fluid and derive Navier stokes equation. (13)	CO1	BTL 4	Analyzing
9.	Explain in detail about the motion mechanics. (13)	CO1	BTL 4	Analyzing
10.	**(i)** The ascending aorta has a diameter d = 2.5 cm, and the HR is 70 bpm. The density, ρ, and the viscosity of blood, μ, are 1.06 g/cm3 and 0.035 P, respectively. Based on these data compute the Womersley parameter. (7) (ii) Flow in the intercostal arteries derives from the thoracic aorta (diameter of ∼2.0 cm) as they branch off to perfuse the musculature of the chest wall. These vessels have a diameter of ∼2 mm with an average velocity of ∼10 cm/s. Determine the Reynolds number. (6)	CO1	BTL 3	Applying
11.	Illustrate parallel forces in space with neat diagrams. (13)	CO1	BTL 4	Analyzing
12.	Summarize the moments of force and couple. (13)	CO1	BTL 3	Applying
13.	Describe the term linear motion used to indicate the motion of points or particles. (13)	CO1	BTL 3	Applying
14.	Illustrate briefly about the Hookean Elastic solid. (13)	CO1	BTL 4	Analyzing
15.	Illustrate the following in detail (i) Constitutive equation (7) (ii) Strain rate (6)	CO1	BTL 3	Applying

16.	State stress and explain it in detail. (13)	CO1	BTL 4	Analyzing
17.	Describe in detail about Newton's Second law of motion with appropriate examples. (13)	CO1	BTL 3	Applying
	PART C			
1.	A rectangular body is subjected to forces as shown in figure. Calcuate the resultant of the forces. (15)  	CO1	BTL 4	Analyzing
2.	Interpret Newtonian viscous fluid with necessary equation. (15)	CO1	BTL 3	Applying
3.	Explain in detail about the link segment model in kinematics. (15)	CO1	BTL 3	Applying
4.	Outline in detail the Newtons law of motion. (15)	CO1	BTL 4	Analyzing
5.	Outline briefly about the solid which obeys Hooke's law. (15)	CO1	BTL 4	Analyzing

UNIT II – BIOFLUID MECHANICS

Intrinsic fluid properties – Density, Viscosity, Compressibility and Surface Tension, Viscometers – Capillary, Coaxial cylinder and cone and plate, Rheological properties of blood, Pressure-flow relationship for Non-Newtonian Fluids, Fluid mechanics in straight tube – Steady Laminar flow, Turbulent flow, Flow development, Viscous and Turbulent Sheer Stress, Effect of pulsatility, Boundary Layer Separation, Structure of blood vessels, Material properties and modelling of Blood vessels, Heart –Cardiac muscle characterisation, Native heart valves – Mechanical properties and valve dynamics, Prosthetic heart valve fluid dynamics.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	What are heart sounds?	CO2	BTL 1	Remembering
2.	How is shear stress developed in laminar and turbulent fluid flow?	CO2	BTL 1	Remembering
3.	Differentiate viscometer and rheometer.	CO2	BTL 2	Understanding
4.	Compile the signs of worsening heart failure.	CO2	BTL 2	Understanding
5.	Summarize the applications of viscosity.	CO2	BTL 2	Understanding
6.	Define Viscosity.	CO2	BTL 1	Remembering
7.	Draw the structure of heart.	CO2	BTL 2	Understanding
8.	List the four types of heart valves and their functions.	CO2	BTL 1	Remembering
9.	Identify the other name of surface tension.	CO2	BTL 2	Understanding

10.	Outline the most common symptoms of heart valve disease.	CO2	BTL 1	Remembering
11.	Classify the different types of viscometer.	CO2	BTL 2	Understanding
12.	Name the three physical properties of fluid.	CO2	BTL 1	Remembering
13.	Draw the typical pressure and flow curves for the left heart.	CO2	BTL 2	Understanding
14.	Construct the graph of some abnormal cardiac patterns.	CO2	BTL 2	Understanding
15.	Point out the advantages of artificial heart valves.	CO2	BTL 1	Remembering
16.	What are systolic and diastolic pressure?	CO2	BTL 1	Remembering
17.	Distinguish between cohesion and surface tension.	CO2	BTL 2	Understanding
18.	Outline the different methods of preventing the separation of boundary layer.	CO2	BTL 2	Understanding
19.	Mention the different types of heart sounds.	CO2	BTL 1	Remembering
20.	How does a Couette viscometer work?	CO2	BTL 1	Remembering
21.	What is steady and turbulent flow?	CO2	BTL 1	Remembering
22.	Enlist the four primary elements present in the mitral and tricuspid valves.	CO2	BTL 2	Understanding
23.	Point out the three types of blood vessels.	CO2	BTL 1	Remembering
24.	Identify the smallest blood vessels in our body. How small are they?	CO2	BTL 2	Understanding
	PART B			
1.	What is Cardiac cycle? Explain it with neat graph. (13)	CO2	BTL 4	Analyzing
2.	Illustrate the following in detail. (i) Density. (6) (ii) Viscosity. (7)	CO2	BTL 4	Analyzing
3.	With neat diagram explain how viscosity is measured using Poiseuille law. (13)	CO2	BTL 3	Applying
4.	A patient has a stenotic aortic valve producing a pressure drop between the left ventricle and the aorta. The mean velocity in the left ventricle proximal (upstream) to the valve is 1 m/s while the mean velocity in the aorta distal (downstream) of the valve is 4 m/s. Applying Equation $p_1-p_2=4v_2^2$, determine the pressure drop across the valve. (13)	CO2	BTL 3	Applying
5.	Explain in detail about the cardiovascular system. (13)	CO2	BTL 3	Applying
6.	Write briefly on structural components of the blood vessel wall .(13)	CO2	BTL 3	Applying
7.	Derive the pressure flow relationship for non-Newtonian fluids that follow the power law. (13)	CO2	BTL 4	Analyzing
8.	Outline in detail about mechanical heart valves. . (13)	CO2	BTL 4	Analyzing
9.	Explain in detail about the Rheological properties of blood. (13)	CO2	BTL 4	Analyzing
10.	Write brief notes on the following (i) Compressibility (7) (ii) Surface tension (6)	CO2	BTL 3	Applying
11.	Write short notes on cone and plate viscometer. (13)	CO2	BTL 3	Applying
12.	Summarize and derive the capillary viscometer with necessary equation. (13)	CO2	BTL 3	Applying
13.	Outline in detail about the material behavior of blood vessels. (13)	CO2	BTL 4	Analyzing
14.	Outline briefly about Laminar flow. (13)	CO2	BTL 4	Analyzing
15.	Describe in detail about the pressure flow relationship for Newtonian viscous fluids that follow Bingham plastic. (13)	CO2	BTL 4	Analyzing
16.	Elaborate coaxial cylinder viscometer with neat diagram. (13)	CO2	BTL 3	Applying

17.	Briefly explain aortic and pulmonary valves in detail. (13)	CO2	BTL 3	Applying
	PART C			
1.	Outline in detail about the electrical activities of the heart. (15)	CO2	BTL 4	Analyzing
2.	Explain in detail about the cardiac output. (15)	CO2	BTL 3	Applying
3.	Elaborate in detail about the vascular mechanics. (15)	CO2	BTL 4	Analyzing
4.	Illustrate briefly about the following in detail (i) Conduction system of the heart (8) (ii) Heart sounds (3) (iii) Heart rate (4)	CO2	BTL 3	Applying
5.	Describe in detail about the pressure flow relationship for non-Newtonian fluids that follow Casson fluids. (15)	CO2	BTL 4	Analyzing

UNIT III – BIOSOLID MECHANICS

Constitutive equation of viscoelasticity – Maxwell &Voight models, anisotropy, Hard Tissues – Structure, blood circulation, elasticity and strength, viscoelastic properties, functional adaptation, Soft Tissues – Structure, functions, material properties and modeling of Soft Tissues – Cartilage, Tendons and Ligaments Skeletal Muscle – Muscle action, Hill's models, mathematical modeling, Bone fracture mechanics, Implants for bone fractures..

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Mention the signs of poor blood circulation.	CO3	BTL 1	Remembering
2.	List the functions of skeletal muscle.	CO3	BTL 1	Remembering
3.	Define anisotropy.	CO3	BTL 1	Remembering
4.	Name any four types of soft tissues.	CO3	BTL 1	Remembering
5.	List some examples of viscoelasticity.	CO3	BTL 1	Remembering
6.	Differentiate viscoelastic and viscoelastic.	CO3	BTL 2	Understanding
7.	What is the major difference between Maxwell and kelvin Voigt model of elasticity?	CO3	BTL 1	Remembering
8.	How do you treat poor blood circulation?	CO3	BTL 1	Remembering
9.	State ligament and its functions?	CO3	BTL 1	Remembering
10.	Classify the types of blood circulation.	CO3	BTL 2	Understanding
11.	Write some of the causes of poor circulation.	CO3	BTL 2	Understanding
12.	Why is it advantageous for bone to be anisotropic?	CO3	BTL 1	Remembering
13.	Write some of the functions of hard tissue.	CO3	BTL 2	Understanding
14.	Outline in detail about the material behavior of blood vessels.	CO3	BTL 1	Remembering
15.	Distinguish between elasticity and strength of materials.	CO3	BTL 2	Understanding
16.	Sketch the Maxwell model.	CO3	BTL 2	Understanding
17.	Distinguish between hard and soft tissues.	CO3	BTL 2	Understanding
18.	Identify the other name of hard tissue and list some of the hard tissue of human.	CO3	BTL 2	Understanding
19.	Mention the four functions of circulatory system.	CO3	BTL 2	Understanding
20.	Draw the schematic of kelvin voigt model.	CO3	BTL 2	Understanding
21.	What causes the bone to be weak?	CO3	BTL 1	Remembering
22.	Write the three most common types of orthopedic implants.	CO3	BTL 2	Understanding
23.	List the three types of cartilage in our body and its functions.	CO3	BTL 1	Remembering

24.	Compare isotropy and anisotropy	CO3	BTL 2	Understanding
	PART B			
1.	How the cartilages are classified? Explain its composition mechanical properties. (13)	CO3	BTL 3	Applying
2.	Illustrate and explain the structure and functions of soft tissues. (13)	CO3	BTL 4	Analyzing
3.	Elaborate Hill three element model with necessary equation. (13)	CO3	BTL 3	Applying
4.	Generalize important points about the different types of Viscoelastic model. (13)	CO3	BTL 3	Applying
5.	Outline in detail about the mechanical properties of bone. (13)	CO3	BTL 4	Analyzing
6.	Sketch the kelvin model with necessary equations. (13)	CO3	BTL 3	Applying
7.	Draw the stress-strain diagram of various materials and explain. (13)	CO3	BTL 3	Applying
8.	Outline briefly about the viscoelasticity in detail. (13)	CO3	BTL 4	Analyzing
9.	Elaborate in detail about the bone fracture mechanism. (13)	CO3	BTL 4	Analyzing
10.	Describe the mechanical properties of cartilage. (13)	CO3	BTL 4	Analyzing
11.	What is Maxwell's model and also derive the expression of Maxwell's model with neat diagram. (13)	CO3	BTL 3	Applying
12.	Explain in detail about the functional adaptation of bone. (13)	CO3	BTL 4	Analyzing
13.	Outline in detail about the hard tissues. (13)	CO3	BTL 4	Analyzing
14.	Describe in detail about (i) Tendons (7) (ii) Ligaments (6)	CO3	BTL 3	Applying
15.	Construct the Voight model with neat diagram and derive the necessary equations. (13)	CO3	BTL 3	Applying
16.	Illustrate in detail about the modelling of composite property of bone. (13)	CO3	BTL 4	Analyzing
17.	Draw the typical stress strain curve for tissue, elastin and collagen and explain. (13)	CO3	BTL 3	Applying
	PART C			
1.	Explain in detail about the Hills equation of tetanized muscles. (15)	CO3	BTL 4	Analyzing
2.	Briefly explain the properties of cancellous bone. (15)	CO3	BTL 3	Applying
3.	Elaborate in detail about the skeletal muscle. (15)	CO3	BTL 4	Analyzing
4.	Describe in detail about the viscoelastic properties of bone. (15)	CO3	BTL 3	Applying
5.	Outline in detail about the teeth and its properties. (15)	CO3	BTL 4	Analyzing

UNIT IV – BIOMECHANICS OF JOINTS

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle, Lubrication of synovial joints, Gait analysis, Motion analysis using video.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Classify the types of joints in the structural classification.	CO4	BTL 2	Understanding
2.	What are the 4 main characteristics of synovial joint?	CO4	BTL 1	Remembering

3.	Outline the two conditions must be met for an object to be in equilibrium.	CO4	BTL 1	Remembering
4.	How accurate is gait analysis?	CO4	BTL 1	Remembering
5.	Why spinal column is important for human movement?	CO4	BTL 1	Remembering
6.	Identify the purpose of free body diagram.	CO4	BTL 2	Understanding
7.	List the different treatments to relieve pain in back of knee.	CO4	BTL 2	Understanding
8.	What is joint stress?	CO4	BTL 1	Remembering
9.	Name the six types of synovial joints.	CO4	BTL 1	Remembering
10.	Outline the functions of hip joint.	CO4	BTL 1	Remembering
11.	Differentiate movement and locomotion?	CO4	BTL 2	Understanding
12.	Define joint force analysis.	CO4	BTL 2	Understanding
13.	Summarize conditions that are used to analyze the equilibrium problems of rigid bodies.	CO4	BTL 2	Understanding
14.	Identify the most used joint in the body.	CO4	BTL 2	Understanding
15.	Mention the other name for knee joint and define it.	CO4	BTL 2	Understanding
16.	Point out the importance of a free body diagram in vector addition.	CO4	BTL 1	Remembering
17.	What are the functions of the elbow.	CO4	BTL 2	Understanding
18.	Compare hip and pelvis.	CO4	BTL 2	Understanding
19.	Mention an example for joint reaction force.	CO4	BTL 2	Understanding
20.	List the seven movements of the shoulder.	CO4	BTL 1	Remembering
21.	Name the Eight joints in the body.	CO4	BTL 1	Remembering
22.	Identify and define the largest joints in the human body.	CO4	BTL 1	Remembering
23.	Sketch the diagram of synovial joints.	CO4	BTL 2	Understanding
24.	Write some of the benefits of using motion video.	CO4	BTL 1	Remembering
	PART B			
1.	Describe in detail about the mechanics of elbow. (13)	CO4	BTL 3	Applying
2.	Outline in detail about mechanics of ankle joint. (13)	CO4	BTL 4	Creating
3.	Enlist the different variables measured during gait analysis and explain it in detail with neat diagram. (13)	CO4	BTL 3	Applying
4.	Elaborate in detail about the osteokinematic movements of shoulder. (13)	CO4	BTL 4	Creating
5.	Identify the largest joint in human body and explain it in detail with neat diagram. (13)	CO4	BTL 3	Applying
6.	What is Gait analysis? Illustrate the sequence of events that must take place for walking to occur. (13)	CO4	BTL 3	Applying
7.	Explain in detail about the mechanics of the hip with neat diagrams. (13)	CO4	BTL 4	Analyzing
8.	Describe in detail about adaptation of bone stress and strain. (13)	CO4	BTL 4	Analyzing
9.	Explain in detail about the lubrication of synovial joints. (13)	CO4	BTL 3	Applying
10.	Sketch the frequent clinically encountered bone fractures characterized by their injury mechanism and explain. (13)	CO4	BTL 4	Analyzing
11.	Write brief note on human joint forces. (13)	CO4	BTL 3	Applying
12.	Illustrate the biomechanical analysis of spinal column in detail. (13)	CO4	BTL 4	Analyzing
13.	Explain the mechanics of Knee joints in detail. (13)	CO4	BTL 4	Analyzing
14.	Analyze the mechanical properties of bone. (13)	CO4	BTL 4	Analyzing

15.	Sketch and suggest a suitable design of surfaces and kinematics limitations of total tibiofemoral prostheses. (13)	CO4	BTL 3	Applying
16.	Why the inverse approach is used in gait analysis? Outline inverse approach in detail with necessary diagrams. (13)	CO4	BTL 4	Analyzing
17.	Describe the different events of gait cycle with necessary diagrams. (13)	CO4	BTL 3	Applying
	PART C			
1.	Explain in detail about the conditions of equilibrium with appropriate examples. (15)	CO4	BTL 3	Applying
2.	Draw stress-strain curve for tissue, elastic and collagen and explain in detail. (15)	CO4	BTL 3	Applying
3.	Describe the mechanics of elbow joint with illustrations. (15)	CO4	BTL 3	Applying
4.	Illustrate motion analysis in detail.. (15)	CO4	BTL 4	Analyzing
5.	Outline in detail about (i) Conditions for rigid body equilibrium (5) (ii) The process of solving rigid body equilibrium problems (5) (iii) Free body diagrams (5)	CO4	BTL 4	Analyzing

UNIT V – MODELING AND ERGONOMIC				
Introduction to Finite Element Analysis, finite element analysis of lumbar spine; Ergonomics – Musculoskeletal disorders, Ergonomic principles contributing to good workplace design, Design of a Computer work station, Whole body vibrations, Hand transmitted vibrations.				
PART – A				
Q.No	**Questions**	**CO**	**BT Level**	**Competence**
1.	How long does it take lumbar strain to heal?	CO5	BTL 1	Remembering
2.	Compare workstation and personal computer.	CO5	BTL 2	Understanding
3.	Mention the five aspects of ergonomics.	CO5	BTL 2	Understanding
4.	Why the lumbar vertebrae is important?	CO5	BTL 1	Remembering
5.	Interpret the meaning of HAVS.	CO5	BTL 2	Understanding
6.	Name the three phases of finite element method.	CO5	BTL 1	Remember
7.	Distinguish between FEM and FEA.	CO5	BTL 2	Understanding
8.	Identify the methods that are generally associated with the finite element analysis.	CO5	BTL 1	Remember
9.	Mention the three primary ergonomic risk factors.	CO5	BTL 1	Remember
10.	Define finite element analysis.	CO5	BTL 1	Remembering
11.	Classify three levels of ergonomic studies.	CO5	BTL 2	Understanding
12.	What is meant by work station computer?	CO5	BTL 1	Remembering
13.	Write the various classification of vibration.	CO5	BTL 1	Remembering
14.	What are the symptoms of lumbar spine?	CO5	BTL 2	Understanding
15.	Outline the main symptoms of hand arm vibration syndrome.	CO5	BTL 2	Understanding
16.	Identify the causes and effect of vibration.	CO5	BTL 1	Remembering
17.	Mention some of the best examples of an ergonomic design.	CO5	BTL 2	Understanding
18.	List the most common ergonomic injuries in the workplace.	CO5	BTL 1	Remembering

19.	Outline the benefits of ergonomics in workplace.	CO5	BTL 1	Remembering
20.	Summarize the most common musculoskeletal injuries.	CO5	BTL 2	Understanding
21.	List the purpose of FEA.	CO5	BTL 1	Remembering
22.	Mention the three major steps of FEA.	CO5	BTL 1	Remembering
23.	Compare whole body vibration and hand transmitted vibrations.	CO5	BTL 2	Understanding
24.	Express how harmful is the whole body vibration.	CO5	BTL 1	Remembering
	PART B			
1.	Describe in detail about the ergonomics of sitting. (13)	CO5	BTL 3	Applying
2.	Illustrate the biomechanical aspects of sitting postures. (13)	CO5	BTL 4	Analyzing
3.	Interpret the basic principle of ergonomics and explain. (13)	CO5	BTL 3	Applying
4.	Outline about the health effects of whole-body vibration. (13)	CO5	BTL 4	Analyzing
5.	Express the detailed view on Ergonomic seat design features. (13)	CO5	BTL 4	Analyzing
6.	What is finite element analysis? Explain any one analysis of biomechanical systems using FEM. (13)	CO5	BTL 3	Applying
7.	Elaborate in detail on Hand transmitted vibrations. (13)	CO5	BTL 4	Analyzing
8.	Outline briefly about common injuries and symptoms associated with ergonomically incorrect computer stations. (13)	CO5	BTL 4	Analyzing
9.	Analyze the biomechanical system using Finite element analysis method. (13)	CO5	BTL 4	Analyzing
10.	Explain in detail about the whole-body response to vibration and shocks. (13)	CO5	BTL 3	Applying
11.	Write brief note on the procedure followed in designing the computer workstation. . (13)	CO5	BTL 3	Applying
12.	(i) Write short notes on Musculoskeletal disorder. (7) (ii) Outline the ways to reduce the Musculoskeletal disorder. (6)	CO5	BTL 3	Applying
13.	Summarize the control measures for whole body vibration. (13)	CO5	BTL 3	Applying
14.	Design a suitable computer workstation to avoid the musculoskeletal disorder. (13)	CO5	BTL 4	Analyzing
15.	What are the causes and risk factors for work-related low back disorders and explain it in detail. (13)	CO5	BTL 3	Applying
16.	Write short notes on (i) Whole body biomechanical model (7) (ii) Hand arm vibration model (6)	CO5	BTL 3	Applying
17.	Outline the Characterization of vibration waveforms. (13)	CO5	BTL 4	Analyzing
	PART C			
1.	Outline about the effect of mechanical vibrations in human. (15)	CO5	BTL 4	Analyzing
2.	Explain in detail about Finite element analysis. (15)	CO5	BTL 3	Applying
3.	Describe the ergonomic principles contributing to the good workplace design. (15)	CO5	BTL 3	Applying
4.	Illustrate the measurement of whole-body vibrations in detail. (15)	CO5	BTL 4	Analyzing
5.	Explain in detail about the static and dynamic posture. (15)	CO5	BTL 3	Applying