**INTEGRAL UNIVERSITY**
**DEPARTMENT OF BIOENGINEERING**

**PROGRAMME: B.Tech. BioMedical Engineering**

## PROGRAM SPECIFIC OUTCOMES (PSO):

**PSO1:** Identify, analyze and solve the real life problems by applying segment principles of Biomedical Engineering with novelty.

**PSO2:** Easily Design, develop and specify the mathematical model to understand the inter-relation among various Physiological systems.

**PSO3:** Investigate, demonstrate and implement various applications of the Biomedical Engineering and physiological subsystems in formulation and monitoring human body systems for smooth health functioning.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

**1.** To embrace responsible roles of highest cadre in their chosen profession through engineering knowledge, skills and teamwork.

**2**. To apply and acquire quantitative, qualitative, analytic and critical thinking skills to solve engineering problems.

**3**. To provide self-directed learning with management principles to identify and create professional opportunities in the field of study.

**4.** To prepare graduates capable of upholding and expanding their technical competence through lifelong learning.

## PROGRAM OUTCOMES (PO):

**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 the 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 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 modelling to complex engineering activities with an understanding of the limitations.

**PO6- The engineer and society:** Apply reasoning informed 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 independent and life-long learning in the broadest context of technological change.

**B.TECH. Biomedical Engineering SEMESTER 3rd**

**HUMAN ANATOMY AND PHYSIOLOGY FOR ENGINEERS**

**COURSE CODE BE272**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | Students will be able to get an in-depth understanding of anatomy and physiology of the cardiovascular system (heart and blood vessel), the pulmonary system (lung), the renal system, the digestive system, the nervous system, the muscular system and the skeletal system. |
| **CO 2** | The discussion of these physiological systems will cover the levels of cell, tissue and organ. |
| **CO 3** | Students will be able to understand the corresponding structure function relationship of these physiological systems. |
| **CO 4** | Students will be able to relate the structure and function of the cardiovascular, circulatory, respiratory, excretory, nervous and digestive systems in humans. |
| **CO 5** | Make measurements on and interpret data of physiological processes in living systems. |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 3 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |
| CO2 | 1 | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | — | 1 | 1 | 2 | 2 | 2 |
| CO3 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 2 |
| CO4 | 1 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 |
| CO5 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 1 |

**BIOCHEMICAL ANALYSIS AND TECHNIQUES**

**BE273**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcome.***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | Identify, understand and explain the working principle of basic analytical & diagnostic equipments used in biomedical engineering domain |
| **CO 2** | Understand and explain the working principle of Blood gas analyzers and Oximeters |
| **CO 3** | Understand and explain the working principle of Blood cell counters and Blood pressure apparatus |
| **CO4** | Understand and explain the working principle of Blood Flowmeters |
| **CO5** | Understand and explain the working principle of Pulmonary function analyzers, Understand and explain the working principle of Endoscopy |

## CO-PO-PSO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 3 |

## HUMAN ANATOMY AND PHYSIOLOGY LAB

## BE274

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | The objective of Engineering Physiology & Anatomy Laboratory class is to understand the practical aspects of the body's internal organs and how they function. |
| **CO 2** | Provide an active learning environment to teach the basic principles of human physiology & anatomy. |
| **CO 3** | Teach students the principles of experimental documentation in a laboratory notebook. |
| **CO4** | Provide students with a hands on opportunity to use commonly used physiological variables measuring equipments. |
| **CO5** | Promote and encourage team work and collaboration among students in the lab |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 2 |
| CO2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 1 | 1 | 2 | 3 | 1 | — | — | — | 3 | 2 | 1 | 2 | — | — | 1 |
| CO4 | 2 | 2 | 3 | 2 | 3 | 1 | 2 | — | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 1 | 1 | 1 | 2 | 1 | — | — | — | 3 | 3 | 2 | 3 | — | — | — |

**4th Semester**

# BIOMECHANICS
**BE275**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | To describe the fundamental of biomechanics. |
| **CO 2** | To Study the deformability, strength, visco elasticity of bone and flexible tissues, modes of loading and failure. |
| **CO 3** | To describe the types and mechanics of skeletal joints. |
| **CO 4** | To describe movement precisely, using well defined terms (*kinematics*) and also to consider the role of force in movement (*kinetics*). |
| **CO 5** | To teach students the unique features of biological flows, especially constitutive laws and boundaries. |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | — | 1 | 1 | 2 | 3 | 2 | 1 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 1 | 3 |

# BIOMEDICAL SIGNALS AND SYSTEMS

## BE276

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | To understand the basic signals in the field of biomedical. |
| **CO 2** | To study origins and characteristics of some of the most commonly used biomedical signals, including ECG, EEG, evoked potentials, and EMG. |
| **CO 3** | To understand Sources and characteristics of noise and artifacts in bio signals. |
| **CO 4** | To understand use of bio signals in diagnosis, patient monitoring and physiological investigation |
| **CO5** | To explore research domain in biomedical signal processing. |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 3 | 1 | 1 | — | 3 | 1 | — | 2 | 1 | 2 | 3 | 1 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 3 | — | 3 | 1 | — | 2 | 1 | 2 | 3 | 1 |
| CO3 | 2 | 3 | 1 | 3 | 1 | 1 | — | 3 | 1 | — | 2 | 1 | 2 | 3 | 1 |
| CO4 | 2 | 3 | 1 | 3 | 1 | 2 | — | 3 | 1 | — | 2 | 1 | 2 | 3 | 1 |
| CO5 | 2 | 2 | 3 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 3 |

**BIOMATERIALS AND ARTIFICALS ORAGANS**
**BE277**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | The student would be able to learn characteristics and classification of Biomaterials. |
| **CO 2** | Understand the characteristics of different metals and ceramics used as biomaterials. |
| **CO 3** | Understand polymeric materials, composites and combinations that could be used as a tissue replacement implants. |
| **CO4** | Students should be able to understand how to develop artificial organ using these materials. |
| **CO5** | Instill a fundamental understanding of the properties and applications of biomaterials, both natural and synthetic that are used in contact with biological systems in the area of various tissues and organ replacement. |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## BIOMATERIALS AND BIOMECHANICS LAB

## BE278

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO 1** | Perform Mechanical characterization & Hardness testing of biomaterials |
| **CO 2** | Measure Surface roughness & haemo-compatibility of biomaterials |
| **CO 3** | Stress Strain analysis of hip prosthesis |
| **CO 4** | Determine moment of inertia of human limb & human bone |
| **CO 5** | Perform Ultrasonic characterization of biomaterials-NDE |

### CO-PO-PSO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 3 | — | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | — | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |

**5th Semester**

## HOSPITAL MANAGEMENT

## BE361

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | Identify various areas of hospitals. |
| **CO2** | Identify various activities of departments like out/in patient and nursing. |
| **CO3** | Discuss about critical care departments of hospital like iccu, icu and activities of central sterile supply department. |
| **CO4** | Discuss about effective hospital management. |
| **CO5** | Maintain various medical records and waste management. |

### CO-PO-PSO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | — | — |
| CO2 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | — | — |
| CO3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | — | 1 |
| CO4 | 1 | 1 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| CO5 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | — | — |

**THERAPEUTIC EQUIPMENTS**

**BE362**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | This course will provide to students brief review of physiology and common pathology from an engineering point of view for understanding of therapeutic medical devices. |
| **CO2** | The lectures will focus on function of therapeutic medical devices so that the students will gain the ability to contribute in their design, development and effective usage in their future careers. |
| **CO3** | To study the concept of various assist devices so as to enable the students to develop new assist devices. |
| **CO4** | To develop an understanding of the physiotherapy and diathermy equipment so that the student can learn to operate. |
| **CO5** | This course is also focus on function of therapeutic medical devices so that the students will gain the ability to contribute in their design, development and effective usage in their future careers. |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**THERAPEUTIC EQUIPMENTS LAB**
**BE363**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | To familiarize students with different types of medical equipments |
| **CO2** | To make them understand about the working principle of versatile medical equipments |
| **CO3** | To familiarize students with the application of such equipments |
| **CO4** | Describe different types of medical equipments |
| **CO5** | Explain the working principle of versatile medical equipments |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# 6th Semester

## TISSUE ENGINEERING

## BE365

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | This course will provide an overview of cell biology fundamentals, an extensive review on extracellular matrix and basics of receptors, followed by topics on cell-cell and cell-matrix interactions at both the theoretical and experimental levels. |
| **CO2** | Subsequent lectures will cover the effects of physical (shear, stress, strain), chemical (cytokines, growth factors), and electrical stimuli on cell function, emphasizing topics on gene regulation and signal transduction processes. |
| **CO3** | Tissue engineering will be introduced by reviewing tissue structure and function and the clinical need for tissue repair. |
| **CO4** | An overview of scaffold design and processing for tissue engineering will be reviewed and the application of tissue engineering to specialized tissues and organs will then be addressed in depth. |
| **CO5** | Specific organ systems include skin, muscular skeletal system (vascular grafts, blood substitutions, cardiac patch, and heart valve), nervous system (peripheral and central nervous systems), liver, pancreas, and kidney. |

### CO-PO-PSO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 1 | 1 | — | — | — | 1 | 2 | 3 | 3 | 2 | 2 | 3 |
| CO2 | 3 | 3 | 1 | 1 | 1 | — | — | — | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## BIOMEDICAL HAZARDS &SAFETY

## BE366

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | Understand the legal framework of the Health and Safety at Work etc. Act 1974 and Regulations associated with it |
| **CO2** | Understand the employers', employees' and visitors' duties |
| **CO3** | Evaluate hazards and risks in order to carry out a risk assessment |
| **CO4** | Understand the legal requirement to report any accident or dangerous occurrence |
| **CO5** | Develop risk assessments for scientific laboratories that use chemicals or biological organisms or both |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 1 | — | 2 | — | 3 | 1 | 3 | 3 | 3 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 1 | — | 1 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 1 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 1 | 3 |
| CO5 | 1 | 1 | 3 | 1 | — | 2 | — | 3 | 1 | 3 | 3 | 3 | 2 | — | 2 |

**TISSUE ENGINEERING LAB**
**BE367**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | Use of conventional microscopy for the understanding of tissue structure |
| **CO2** | Understand microscopic organization of Tissues into Organs and system |
| **CO3** | Tissue observation and image capture |
| **CO4** | Histology as a diagnostic tool |
| **CO5** | Use of Immuno-histochemical techniques |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# 7th Semester

## BIOTELEMETRY & TELEMEDICINE

## BE452

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | To familiarize students with basic concepts of Biotelemetry &Telemedicine |
| **CO2** | To teach students the application of Biotelemetry &Telemedicine |
| **CO3** | Describe basic Telemetry, Biotelemetry & Telemedicine system/subsystems . |
| **CO4** | Explain the application of Biotelemetry & Telemedicine in modern healthcare technology |
| **CO5** | Identify and describe modern telemedical technologies |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | — | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | — | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |

**MEDICAL IMAGE PROCESSING**
**BE453**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | To introduce the learners the basic theory of digital image processing. |
| **CO2** | To expose learners to various available techniques and possibilities of this field. |
| **CO3** | To understand the basic image enhancement, transforms, segmentation, compression, morphology, representation, description techniques &algorithms. |
| **CO4** | To prepare learners to formulate solutions to general image processing problems. |
| **CO5** | To develop hands-on experience in using computers to process images. |

## CO-PO-PSO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |

**MEDICAL INFORMATICS**
**BE454**

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

**Course Outcomes:**

| COURSE OUTCOME (CO) | CO DESCRIPTION |
|---|---|
| **CO1** | Expose to the need for Bioinformatics tools |
| **CO2** | Be familiar with the modelling techniques |
| **CO3** | Learn microarray analysis |
| **CO4** | Expose to Pattern Matching and Visualization |
| **CO5** | Apply pattern matching techniques to bioinformatics data – protein data genomic data. Apply micro array technology for genomic expression study |

## CO-PO-PSO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 |

## DESIGN CONCEPT & MAINTENANCE OF BIOMEDICAL INSTRUMENTS
## BE455

**Course Outcomes:** ***After completion of the course, a student will be able to achieve these outcomes***

| **Course Outcome (COs)** | |
|---|---|
| **CO1** | To introduce students with fundamentals instrumentation of the equipments used in health care systems. |
| **CO2** | To familiarize students with the application and troubleshooting, maintenance and repairing aspects of versatile medical equipments. |
| **CO3** | Identify various medical equipments used in medical institute/research centres. |
| **CO4** | Explain the working theories of medical instruments. |
| **CO5** | Show the skills in the view points of maintenance, repairing and troubleshooting of medical equipments. |

**CO-PO/PSO map**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 1 |

**MEDICAL IMAGE PROCESSING LAB**

**BE456**

**COURSE OUTCOMES:**

***After completion of the course, a student will be able to achieve these outcomes***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | Knowledge in the science of medical images and image processing, including mathematical transforms. |
| **CO2** | Knowledge in the techniques of Digital Image Processing, including Image Enhancement in the Spatial and Frequency Domain, Compression, Morphology and Segmentation. |
| **CO3** | Knowledge Current science and technological practice in industry and advanced research topics in this area |
| **CO4** | To enhance the medical images by applying various filters and segment the region of interest using various image processing Algorithms |
| **CO5** | To gain the practical knowledge about the processing of medical images, understand the fundamentals of digital image and its properties |

**CO-PO/PSO map**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |

| Course Code: | Course Name | Sem | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE272 | Human Anatomy and Ph | 3rd | CO1 | 1 | 2 | 3 |
| BE272 | Human Anatomy and Ph | 3rd | CO2 | 1 | 1 | 3 |
| BE272 | Human Anatomy and Ph | 3rd | CO3 | 1 | 2 | 1 |
| BE272 | Human Anatomy and Ph | 3rd | CO4 | 1 | 1 | 2 |
| BE272 | Human Anatomy and Ph | 3rd | CO5 | 3 | 1 | 2 |
| **BE272** | **Human Anatomy and Pl** | **3rd** | **BE272** | **1.4** | **1.4** | **2.2** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE273 | Biochemical Analysis | 3rd | CO1 | 3 | 3 | 3 |
| BE273 | Biochemical Analysis | 3rd | CO2 | 2 | 3 | 3 |
| BE273 | Biochemical Analysis | 3rd | CO3 | 2 | 3 | 3 |
| BE273 | Biochemical Analysis | 3rd | CO4 | 2 | 3 | 3 |
| BE273 | Biochemical Analysis | 3rd | CO5 | 2 | 3 | 3 |
| **BE273** | **Biochemical Analysis** | **3rd** | **B3273** | **2.2** | **3** | **3** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE274 | Human Anatomy and | 3rd | CO1 | 1 | 1 | 1 |
| BE274 | Human Anatomy and | 3rd | CO2 | 1 | 1 | 1 |
| BE274 | Human Anatomy and | 3rd | CO3 | 1 | 1 | 2 |
| BE274 | Human Anatomy and | 3rd | CO4 | 2 | 2 | 3 |
| BE274 | Human Anatomy and | 3rd | CO5 | 1 | 1 | 1 |
| **BE274** | **Human Anatomy and** | **3rd** | **B3274** | **1.2** | **1.2** | **1.6** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE275 | Biomechanics | 4th | CO1 | 3 | 3 | 1 |
| BE275 | Biomechanics | 4th | CO2 | 1 | 1 | 2 |
| BE275 | Biomechanics | 4th | CO3 | 2 | 1 | 2 |
| BE275 | Biomechanics | 4th | CO4 | 2 | 2 | 3 |
| BE275 | Biomechanics | 4th | CO5 | 2 | 3 | 3 |
| **BE275** | **Biomechanics** | **4th** | **B3275** | **2** | **2** | **2.2** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE276 | Biomedical Signals an | 4th | CO1 | 3 | 3 | 1 |
| BE276 | Biomedical Signals an | 4th | CO2 | 3 | 3 | 3 |
| BE276 | Biomedical Signals an | 4th | CO3 | 2 | 3 | 1 |
| BE276 | Biomedical Signals an | 4th | CO4 | 2 | 3 | 1 |
| BE276 | Biomedical Signals an | 4th | CO5 | 2 | 2 | 3 |
| **BE276** | **Biomedical Signals a** | **4th** | **B3276** | **2.4** | **2.8** | **1.8** |

| PO1 | PO2 | PO3 |
|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| BE277 | Biomaterial and Artifi | 4th | CO1 | 3 | 3 | 3 |
| BE277 | Biomaterial and Artifi | 4th | CO2 | 3 | 3 | 3 |
| BE277 | Biomaterial and Artifi | 4th | CO3 | 3 | 3 | 3 |
| BE277 | Biomaterial and Artifi | 4th | CO4 | 3 | 3 | 3 |
| BE277 | Biomaterial and Artifi | 4th | CO5 | 3 | 3 | 3 |
| **BE277** | **Biomaterial and Arti** | **4th** | **B3277** | **3** | **3** | **3** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE278 | Biomaterial and Bio M | 4th | CO1 | 3 | 3 | 2 |
| BE278 | Biomaterial and Bio M | 4th | CO2 | 3 | 3 | 2 |
| BE278 | Biomaterial and Bio M | 4th | CO3 | 3 | 3 | 3 |
| BE278 | Biomaterial and Bio M | 4th | CO4 | 3 | 3 | 3 |
| BE278 | Biomaterial and Bio M | 4th | CO5 | 3 | 3 | 3 |
| BE278 | **Biomaterial and Bio** | **4th** | **BE278** | **3** | **3** | **2.6** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE361 | Hospital Management | 5th | CO1 | 2 | 2 | 3 |
| BE361 | Hospital Management | 5th | CO2 | 1 | 1 | 3 |
| BE361 | Hospital Management | 5th | CO3 | 3 | 3 | 3 |
| BE361 | Hospital Management | 5th | CO4 | 1 | 1 | 3 |
| BE361 | Hospital Management | 5th | CO5 | 1 | 1 | 3 |
| **BE361** | **Hospital Managemer** | **5th** | **B361** | **1.6** | **1.6** | **3** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE362 | Therapeutic Equipmer | 5th | CO1 | 3 | 3 | 3 |
| BE362 | Therapeutic Equipmer | 5th | CO2 | 3 | 3 | 3 |
| BE362 | Therapeutic Equipmer | 5th | CO3 | 3 | 3 | 2 |
| BE362 | Therapeutic Equipmer | 5th | CO4 | 3 | 3 | 2 |
| BE362 | Therapeutic Equipmer | 5th | CO5 | 3 | 3 | 3 |
| **BE362** | **Therapeutic Equipm** | **5th** | **B362** | **3** | **3** | **2.6** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE363 | Therapeutic Equipmer | 5th | CO1 | 3 | 3 | 3 |
| BE363 | Therapeutic Equipmer | 5th | CO2 | 3 | 3 | 3 |
| BE363 | Therapeutic Equipmer | 5th | CO3 | 3 | 3 | 3 |
| BE363 | Therapeutic Equipmer | 5th | CO4 | 3 | 3 | 3 |
| BE363 | Therapeutic Equipmer | 5th | CO5 | 3 | 3 | 3 |
| **BE363** | **Therapeutic Equipm** | **5th** | **BE363** | **3** | **3** | **3** |

| PO1 | PO2 | PO3 |
|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| BE365 | Tissue Engineering | 6th | CO1 | 3 | 3 | 1 |
| BE365 | Tissue Engineering | 6th | CO2 | 3 | 3 | 1 |
| BE365 | Tissue Engineering | 6th | CO3 | 3 | 3 | 3 |
| BE365 | Tissue Engineering | 6th | CO4 | 3 | 3 | 3 |
| BE365 | Tissue Engineering | 6th | CO5 | 3 | 3 | 3 |
| **BE365** | **Tissue Engineering** | **6th** | **BE365** | **3** | **3** | **2.2** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE366 | Biomedical Hazards a | 6th | CO1 | 2 | 2 | 3 |
| BE366 | Biomedical Hazards a | 6th | CO2 | 3 | 3 | 3 |
| BE366 | Biomedical Hazards a | 6th | CO3 | 3 | 3 | 3 |
| BE366 | Biomedical Hazards a | 6th | CO4 | 3 | 3 | 3 |
| BE366 | Biomedical Hazards a | 6th | CO5 | 1 | 1 | 3 |
| **BE366** | **Biomedical Hazards** | **6th** | **BE366** | **2.4** | **2.4** | **3** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE367 | Tissue Engineering La | 6th | CO1 | 3 | 3 | 3 |
| BE367 | Tissue Engineering La | 6th | CO2 | 3 | 3 | 3 |
| BE367 | Tissue Engineering La | 6th | CO3 | 3 | 3 | 3 |
| BE367 | Tissue Engineering La | 6th | CO4 | 3 | 3 | 3 |
| BE367 | Tissue Engineering La | 6th | CO5 | 3 | 3 | 3 |
| **BE367** | **Tissue Engineering L** | **6th** | **BE367** | **3** | **3** | **3** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE452 | Biotelemetry and Tele | 7th | CO1 | 3 | 3 | 3 |
| BE452 | Biotelemetry and Tele | 7th | CO2 | 3 | 3 | 3 |
| BE452 | Biotelemetry and Tele | 7th | CO3 | 3 | 3 | 2 |
| BE452 | Biotelemetry and Tele | 7th | CO4 | 2 | 2 | 3 |
| BE452 | Biotelemetry and Tele | 7th | CO5 | 3 | 2 | 3 |
| **BE452** | **Biotelemetry and Tel** | **7th** | **BE452** | **2.8** | **2.6** | **2.8** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE453 | Medical Image Proces | 7th | CO1 | 3 | 3 | 3 |
| BE453 | Medical Image Proces | 7th | CO2 | 3 | 3 | 3 |
| BE453 | Medical Image Proces | 7th | CO3 | 3 | 3 | 3 |
| BE453 | Medical Image Proces | 7th | CO4 | 3 | 3 | 2 |
| BE453 | Medical Image Proces | 7th | CO5 | 3 | 3 | 3 |
| **BE453** | **Medical Image Proce** | **7th** | **BE453** | **3** | **3** | **2.8** |

| PO1 | PO2 | PO3 |
|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| BE454 | Medical Informatics | 7th | CO1 | 3 | 3 | 2 |
| BE454 | Medical Informatics | 7th | CO2 | 3 | 3 | 3 |
| BE454 | Medical Informatics | 7th | CO3 | 3 | 3 | 3 |
| BE454 | Medical Informatics | 7th | CO4 | 3 | 3 | 3 |
| BE454 | Medical Informatics | 7th | CO5 | 3 | 3 | 3 |
| **BE454** | **Medical Informatics** | **7th** | **BE454** | **3** | **3** | **2.8** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE455 | Design Concept and M | 7th | CO1 | 3 | 3 | 3 |
| BE455 | Design Concept and M | 7th | CO2 | 3 | 3 | 3 |
| BE455 | Design Concept and M | 7th | CO3 | 3 | 3 | 3 |
| BE455 | Design Concept and M | 7th | CO4 | 3 | 3 | 3 |
| BE455 | Design Concept and M | 7th | CO5 | 2 | 2 | 2 |
| **BE455** | **Design Concept and** | **7th** | **BE455** | **2.8** | **2.8** | **2.8** |

| | | | | PO1 | PO2 | PO3 |
|---|---|---|---|---|---|---|
| BE456 | Medical Image Proces | 7th | CO1 | 3 | 3 | 2 |
| BE456 | Medical Image Proces | 7th | CO2 | 3 | 3 | 2 |
| BE456 | Medical Image Proces | 7th | CO3 | 3 | 3 | 2 |
| BE456 | Medical Image Proces | 7th | CO4 | 3 | 3 | 2 |
| BE456 | Medical Image Proces | 7th | CO5 | 3 | 3 | 3 |
| **BE456** | **Medical Image Proce** | **7th** | **BE456** | **3** | **3** | **2.2** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 2 | 1 | — | 1 |
| 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| **2.0** | **1.2** | **1.2** | **1.2** | **2.0** | **1.0** | **1.0** | **1.0** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 2 | 3 | 3 | 2 | 3 | 3 | 1 | 3 |
| 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 |
| 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 |
| 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 |
| 2 | 3 | 3 | 2 | 2 | 2 | 1 | 3 |
| **2** | **3** | **3** | **2** | **2.8** | **2.2** | **1** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 |
| 2 | 1 | 1 | 1 | 2 | 2 | 1 | 3 |
| 3 | 1 | — | — | — | 3 | 2 | 1 |
| 2 | 3 | 1 | 2 | — | 3 | 2 | 3 |
| 2 | 1 | — | — | — | 3 | 3 | 2 |
| **2.2** | **1.6** | **1** | **1.333333** | **2** | **2.6** | **1.8** | **2.4** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 2 | 1 | 1 | 1 | — | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | — | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | — | 1 | 1 | 1 |
| 3 | 1 | 1 | 1 | — | 1 | 1 | 2 |
| 3 | 2 | 2 | 1 | 2 | 1 | 1 | 3 |
| **2** | **1.2** | **1.2** | **1** | **2** | **1** | **1** | **1.6** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 1 | 1 | — | 3 | 1 | — | 2 |
| 2 | 3 | 3 | — | 3 | 1 | — | 2 |
| 3 | 1 | 1 | — | 3 | 1 | — | 2 |
| 3 | 1 | 2 | — | 3 | 1 | — | 2 |
| 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 |
| **2.6** | **1.8** | **2** | **1** | **2.8** | **1** | **2** | **2.2** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 2 | 3 | 1 | 2 | 2 |
| 2 | 3 | 3 | 1 | 3 | 1 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| **2.8** | **2.8** | **3** | **2.2** | **3** | **2** | **2.6** | **2.6** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 1 | 3 | — | 3 | 3 | 3 | 3 |
| 3 | 1 | 3 | — | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **3** | **1.8** | **3** | **1** | **3** | **3** | **3** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| **1** | **1.4** | **2** | **3** | **3** | **3** | **3** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 2 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **2** | **2.8** | **3** | **1** | **3** | **3** | **3** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| **3** | **3** | **3** | **2** | **3** | **3** | **3** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | — | — | — | 1 | 2 | 3 |
| 1 | 1 | — | — | — | 1 | 2 | 3 |
| 3 | 3 | 1 | 1 | 2 | 2 | 3 | 3 |
| 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 |
| **2.2** | **2.2** | **1** | **1** | **2.666667** | **2** | **2.6** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 1 | — | 2 | — | 3 | 1 | 3 | 3 |
| 1 | 3 | 2 | 1 | 2 | 1 | 2 | 3 |
| 3 | 2 | 2 | 1 | 2 | 1 | 2 | 3 |
| 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 |
| 1 | — | 2 | — | 3 | 1 | 3 | 3 |
| **1.6** | **3** | **2** | **1** | **2.4** | **1** | **2.4** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| **3** | **3** | **3** | **2** | **3** | **3** | **2.8** | **2.6** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 2 | 2 | 2 | — | 2 | 2 | 2 | 3 |
| 3 | 3 | 2 | — | 2 | 2 | 2 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| **2.8** | **2.8** | **2.6** | **2** | **2.4** | **2.6** | **2.6** | **2.8** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| **3** | **3** | **2.6** | **1** | **3** | **3** | **2.8** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | 3 | 3 | 1 | 3 | 2 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2.8** | **3** | **3** | **2.6** | **3** | **2.8** | **3** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 1 | 3 | 3 | 2 | 3 |
| **2.8** | **3** | **3** | **1** | **3** | **3** | **2.8** | **3** |

| PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 2 | 1 | 3 | 2 | 2 | 3 |
| 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| **2.8** | **3** | **2.6** | **1.2** | **3** | **2.8** | **2.8** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 1 | 3 | 1 | 2 |
| 1 | 2 | 2 | 2 |
| 1 | 3 | 2 | 2 |
| 1 | 1 | 3 | 2 |
| 1 | 2 | 3 | 1 |
| **1.0** | **2.2** | **2.2** | **1.8** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| **3** | **3** | **2** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 2 | 3 | 3 | 2 |
| 3 | 3 | 2 | 2 |
| 2 | — | — | 1 |
| 2 | 3 | 3 | 3 |
| 3 | — | — | — |
| **2.4** | **3** | **2.666667** | **2** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 3 | 2 | 1 | 3 |
| 3 | 3 | 1 | 3 |
| **1.8** | **1.6** | **1** | **1.8** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 1 | 2 | 3 | 1 |
| 1 | 2 | 3 | 1 |
| 1 | 2 | 3 | 1 |
| 1 | 2 | 3 | 1 |
| 2 | 2 | 2 | 3 |
| **1.2** | **2** | **2.8** | **1.4** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| **3** | **3** | **2.8** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 1 | 3 |
| 3 | 2 | 1 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 |
| **3** | **2.6** | **2** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | — | — |
| 3 | 2 | — | — |
| 3 | 3 | — | 1 |
| 3 | 2 | 1 | 1 |
| 3 | 2 | — | — |
| **3** | **2.2** | **1** | **1** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| **3** | **3** | **3** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| **3** | **3** | **3** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 3 | 2 | 2 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| **3** | **2.8** | **2.8** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 1 | 2 |
| 3 | 1 | — | 1 |
| 3 | 2 | 1 | 3 |
| 3 | 2 | 1 | 3 |
| 3 | 2 | — | 2 |
| **3** | **1.8** | **1** | **2.2** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 2 | 3 |
| 3 | 2 | 2 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| **3** | **2.6** | **2.6** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 2 | 2 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| **3** | **2.8** | **2** | **2.8** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 3 | 3 |
| 3 | 2 | 2 | 3 |
| 3 | 2 | 3 | 3 |
| 3 | 2 | 3 | 3 |
| 3 | 2 | 3 | 3 |
| **3** | **2** | **2.8** | **3** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 3 | 2 | 1 | 2 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 1 | 3 |
| **3** | **2.8** | **1.6** | **2.8** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 3 | 3 | 3 |
| 3 | 1 | 1 | 1 |
| **3** | **2.4** | **2.4** | **2.4** |

| PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| 3 | 2 | 3 | 3 |
| 3 | 2 | 3 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| 3 | 3 | 2 | 3 |
| **3** | **2.6** | **2.4** | **3** |