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| --- | --- | --- | --- | --- | --- | --- | --- |
| Course Handout | | | | | | | |
| 1 | Course details | | | | | | |
| Course Coordinator | Dr. Pinki Chakraborty | | | | | |
| Faculty Name | Dr. Pinki Chakraborty | | | | | |
| Programme | B.Tech | | | | | |
| Semester | Sem-II | | | | | |
| Section | Section -1, 7 n 23 | | | | | |
| Course code | BBS01T1008 | | | | | |
| Course Name | Biology for Engineers | | | | | |
| 3 | Mission of the School of Computing Science and Engineering | | | | | | |
| 1. Create a strong foundation on fundamentals of SCSE through OB-TLP 2. Establish state-of-the-art facilities for Analysis, Design and Implementation to develop sustainable ethical solutions 3. Conduct multidisciplinary research for developing innovative solutions 4. Involve the students in group activity including that of professional bodies to develop leadership and communication skills. | | | | | | |
| 4 | Programme educational objectives (PEOs) | | | | | | |
| PEO1 | Graduates of Computer Science and Engineering will be globally competent and provide sustainable solutions for interdisciplinary problems as team players. | | | | | |
| PEO2 | Graduates of Computer Science and Engineering will engage in professional activities with ethical practices in the field of Computer Science & Engineering to enhance their own stature to contribute society. | | | | | |
| PEO3 | Graduates of Computer Science and Engineering will acquire specialize knowledge in trending technologies for research, innovation and product development. | | | | | |
| 5 | Programme outcomes | | | | | | |
| PO1 | Engineering knowledge | | | | | |
| PO2 | Problem analysis | | | | | |
| PO3 | Design & Development of Solutions | | | | | |
| PO4 | Investigation of Problem | | | | | |
| PO5 | Modern tool usage | | | | | |
| PO6 | Engineer and society | | | | | |
| PO7 | Environment& sustainability | | | | | |
| PO8 | Ethics | | | | | |
| PO9 | Individual & team work | | | | | |
| PO10 | Communication | | | | | |
| PO11 | Project management & finance | | | | | |
| PO12 | Lifelong learning | | | | | |
| 6 | Programme specifics outcome (PSO) (if any) - | | | | | | |
| PSO1 | To train students in trending technologies like Machine Learning, Artificial Intelligence, and Augmented reality. | | | | | |
| PSO2 | To develop insights for problem solving in Data Analytics and Ubiquitous Computing. | | | | | |
| 7 | Course outcomes (COs): After the completion of this course, students will be able to:   |  |  | | --- | --- | | CO1 | Understand about cell, tissue, organ and systems | | CO2 | Understand functioning of various systems of human body | | CO3 | Analyse the Measuring & Recording Instruments for recording vital parameters in diagnosis | | CO4 | Understand and examine the role of Monitoring Instruments in clinical practices | | CO5 | Demonstrate the capability of the modern imaging systems for diagnostic applications | | CO6 | Evaluate the applications of Medical devices for Therapy and Prosthetic in biosystems | | | | | | | |
| 8 | Evaluation Component | | Duration | **Marks** | Date &Time | Nature of Component | Scale down Marks |
| CAT-1 | | 90 mins | 30 | As per Academic Calendar | Closed Book | 15 |
| CAT-2 | | 90 mins. | 30 | As per Academic Calendar | Closed Book |
| CAT-3 / Presentation (Seminar/mini-project/poster) | | 5 -15 minutes/ student | 30 | As per Academic Calendar | Open Book |
| (IA-1 to IA-4)  Quiz / Assignments / surprising tests. etc. | | 10-20 mins for each | 4 x 5 = 20 | As per Academic Calendar | Closed Book | 10 |
| IA-5 | | During the session | 5 | During the session | Co-Curricular Activity |
| IA-6 | | During the session | 5 | During the session | Extra- Curricular Activity |
|  | End Term Examination (ETE) | | 180 mins. | 50 | As per Academic Calendar | Closed Book | 25 |
| 9 | List of teaching –learning pedagogy  White board and class discussion/ PPTs presentation, Lesson Plan and course handout, LMS-Moodle, Student’s seminar, Self learning (NPTEL) | | | | | | |
| 10 | Open hour for students:  Monday: 3.00P.M -5.00 PM  As per the type of topic and completion of the modules– Interactive discussion, PPT | | | | | | |
| 11 | Link address for course materials:  <https://lms.galgotiasuniversity.edu.in/course/view.php?id=49284> | | | | | | |
| 12 | Recommended list of e-books:   * [Biology for Engineers](https://originindia.oup.com/product/biology-for-engineers-9780199498741?). Oxford University Press, May 2019. * Continuum Analysis of Biological Systems: Conserved Quantities, Forces and Fluxes, Undergraduate book, with a foreword by Professor R. Byron Bird Springer Publishing as a part of their book series on Biosystems and Bio-robotics, March 2014 * Editor, Biotechnology Section, with B.L.Tembe, Chemistry text book (ET-105, Part B): for the Indira Gandhi National Open University, IGNOU Press, New Delhi (1995). * **Biology for Engineering and other Non-biologists** <https://nptel.ac.in/courses/121106008/> | | | | | | |
| 14 | Recommended list of mini projects / projects/ technical training etc:  None | | | | | | |
| 15 | Students’ Presentation:  As per schedule | | | | | | |
| 17 | List of NPTEL/MOOCS/SWAYAM/Courses/Video:  Swayam- [https://swayam.gov.in/](about:blank)  NPTEL- <https://nptel.ac.in/courses/121/106/121106008/>  E-content videos | | | | | | |
| 18 | Content beyond Syllabus: Module-6 with current advancement and recent applications | | | | | | |
| 19 | List of mini projects/projects:  None | | | | | | |

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|  | **Detail academic calendar of lecture topics** | | | | | | | |
| **Lecture No.** | **Date** | **Topics to be covered** | **Learning outcomes of each topic** | | **Related Unit of syllabus** | **Total lecture in the Unit** | | **Reference  Chap./Sec. (Book)** |
|  |  | Brief Introduction to the Course including its importance to the students in their future career & applications in the profession, Evaluation/Grading pattern, Review (Preliminary topics), Name of Text Books and Reference Books etc. | Overview of course | | Unit -1 | 06 | | Course handout n session plan |
|  |  | Cell membrane structure and Intracellular compartments | Cell membrane | | Study material 1, 2 n 3 |
|  |  | Cell membrane structure and Intracellular compartments | Study material 1, 2 n 3 |
|  |  | Macromolecules: Shape and Information | Macromolecules | | Study material 1, 2 n 3 |
|  |  | Introduction to the central Dogma of information transfer | Central Dogma | | Study material 1, 2 n 3 |
|  |  | Introduction to the central Dogma of information transfer | Study material 1, 2 n 3 |
|  |  | Digestion-, regulation of food intake and digestive secretions | Digestion | | UNIT 2 | 10 | | Study material 3 n 4 |
|  |  | Digestion-, regulation of food intake and digestive secretions | Digestion | | Study material 3 n 4 |
|  |  | Structure of brain, Physiology of nerve impulse conduction | Structure of brain | | Study material 3 n 4 |
|  |  | Cardiovascular System - Physiology of blood – compositions & structure, coagulation; | Cardiovascular System | | Study material 3 n 4 |
|  |  | Heart: beat, initiation, conduction and regulation; | Cardiovascular System | | Study material 3 n 4 |
|  |  | Physiology of Circulation- blood | Physiology of Circulation- blood | | Study material 3 n 4 |
|  |  | Respiration: Physiology of respiration | Physiology of respiration | |  |  | | Study material 3 n 4 |
|  |  | Exchange and transport of gases and its regulation. | Exchange and transport of gases | | UNIT 3 | 09 | | Study material 3 n 4 |
|  |  | Resting potential, action potentials, synaptic potentials, | Resting potential, action potentials, | | Study material 3 n 4 |
|  |  | Exhitatory Post Synaptic Potentials (EPSP) n IPSP | EPSP n IPSP | | Study material 3 n 4 |
|  |  | interaction of signals and Bioelectric signals ECG generation and propagation | ECG generation and propagation | | Study material 3 n 4 |
|  |  | EMG, and its generation and propagation, | Foetal Monitoring Instruments | | Study material 3 n 4 |
|  |  | EEG, and its generation and propagation, | EEG, and its generation | | Study material 3 n 4 |
|  |  | Recording Electrodes, Electrocardiograph, | Electrocardiograph, | | Study material 3 n 4 |
|  |  | Biopotentials | Biopotentials | | Study material 3 n 4 |
|  |  | Depolarisation and Repolarisation | Depolarisation and Repolarisation | | Study material 3 n 4 |
|  |  | Audiometers and Hearing Aids | Audiometers and Hearing Aids | | UNIT 4 | 05 | | Study material 5 |
|  |  | Pulse oximeter | Pulse oximeter | | Study material 5 |
|  |  | Foetal Monitoring Instruments, | Monitoring Instruments, | | Study material 5 |
|  |  | Blood Gas Analysers, Blood Cell Counters | Blood Gas Analysers, Blood Cell Counters | | Study material 5 |
|  | | |
|  |  | Electrocardiograph, Electroencephalograph, Electromyograph | Bio potentials | | Study material 3 n 4 |
|  |  | X**-**ray, X-ray Computed Tomography, Nuclear Medical Imaging Systems | X-ray Computed Tomography, | | Unit-5 n 6 | 07 | | Study material 5 |
|  |  | Magnetic Resonance Imaging System, Ultrasonic Imaging Systems | Imaging System | | Study material 5 |
|  |  | electromagnetic therapy, Radiotherapy | electromagnetic therapy, Radiotherapy | | Study material 5 |
|  |  | Biocompatibility of artificial organs or biomaterials | Biocompatibility of artificial organs or biomaterials | | Study material 5 |

**Course Objectives:**

Students will understand about the different dimensions of Bio Systems engineering in the field of healthcare and clinical practices.

**Course Outcomes:**

After completion of this course work students able to

|  |  |
| --- | --- |
| CO1 | Understand about cell, tissue, organ and systems |
| CO2 | Understand functioning of various systems of human body |
| CO3 | Analyse the Measuring & Recording Instruments for recording vital parameters in diagnosis |
| CO4 | Understand and examine the role of Monitoring Instruments in clinical practices |
| CO5 | Demonstrate the capability of the modern imaging systems for diagnostic applications |
| CO6 | Evaluate the applications of Medical devices for Therapy and Prosthetic in biosystems |

**Course Contents**

|  |  |
| --- | --- |
| **Unit-1: Cell and Molecular Biology** | **7 hours** |
| Cell membrane structure and Intracellular compartments, Macromolecules: Structure,  Shape and Information, Introduction to the central Dogmaof information transfer. |  |
| **Unit 2–: Physiology** | **13 Lectures** |
| ***Digestion-*** Physiology of digestion, regulation of food intake and digestive secretions. ***Coordination*** - Structure of Brain and Neurons; Physiology of nerve impulse conduction, excitability of membranes, electrical and chemical transmission between cells. ***Cardiovascular System*** - Physiology of blood – compositions & structure, coagulation; Heart: beat, initiation, conduction and regulation; Physiology of Circulation. ***Respiration and Excretion-*** Physiology of respiration; Exchange and transport of gases and its regulation. Physiology of Excretion, Fluid and electrolytes balance, Acid Base balance. Roles of kidney in body water regulation. |  |
| **Unit-3 Biopotentials** | **6 hours** |
| Resting potential, action potentials, synaptic potentials, Exhitatory Post Synaptic Potentials (EPSP) Inhibitory Post synaptic Potentials (IPSP), interaction of signals and Bioelectric signals ECG, EMG, EEG, and its generation and propagation |  |
| **Unit-4 Patient Recording and Monitoring Instruments** | **7 hours** |
| Recording Electrodes, Electrocardiograph, Electroencephalograph, Electromyograph Patient Monitoring Systems, Foetal Monitoring Instruments, Oximeters, Blood Flowmeters, Pulmonary Function Analysers, Blood Gas Analysers, Blood Cell Counters, Audiometers and Hearing Aids, |  |
| **Unit-5 Modern imaging systems and Advances in Healthcare** | **6 hours** |
| X**-**ray, X-ray Computed Tomography, Nuclear Medical Imaging Systems, Magnetic  Resonance Imaging System, Ultrasonic Imaging Systems. |  |
| **Unit-6 Advances in Healthcare** | **6 hours** |
| Tissue engineering as therapeutics, electromagnetic therapy, bio ceramics, microrobots and nanobots, Biomaterials, Radiotherapy, Ultrasound Enhanced Nano medicine, and targeted drug delivery, Automated Drug Delivery Systems Artificial skin, limb, advancement in prosthetics, Biocompatibility of artificial organs |  |

**Suggested Readings:**

1. Introduction to Biomedical Engineering by John Enderle, Susan Blanchard and Joseph

Bronzino, Academic Press ELSEVIER

(2) Tissue Engineering by Clemens van Blitterswijk (Editor),Peter Thomsen (Editor),Jeffrey

Hubbell (Editor),Ranieri Cancedda (Editor),Joost de Bruijn (Editor),Anders Lindahl

(Editor),Jerome Sohier (Editor),David F. Williams (Editor), Academic Press

(3) Molecular Cell Biology by Harvey Lodish (Author),David Baltimore (Author),Arnold Berk (Author),W H Freeman & Co (Sd)

(4) Cell Biology & Molecular Biology by N. Arumugam, Saras Publication

**Reference Books:**

(1) Medical Physics by John R. Cameron and James G. Skofronick, John Wiley & Sons, NY

(2) Handbook of Biomedical Instrumentation by R. S. Khandpur, Tata McGraw- Hill

(3) Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

**Course outcomes and Program outcomes mapping**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/PO Mapping** | | | | | | | | | | | | |
| (S/M/W indicates strength of correlation) S-Strong, M-Medium, L-Low | | | | | | | | | | | | |
| Cos | Programme Outcomes(POs) | | | | | | | | | | | |
| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|  |  |  |  |  |  |  |  |  |
| CO1 | 2 |  |  |  |  |  |  |  |  |  |  | 1 |
| CO2 | 2 |  |  |  |  |  |  |  |  |  |  | 1 |
| CO3 | 2 |  |  |  | 2 |  |  |  |  |  |  | 1 |
| CO4 | 2 |  |  |  | 2 |  |  |  |  |  |  | 1 |
| CO5 | 2 |  |  |  | 2 |  |  |  |  |  |  | 1 |
| CO6 | 2 |  |  |  | 2 |  |  |  |  |  |  | 1 |

**Continuous Assessment Pattern:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mode/ Category** | **Internal Assessment (IA)** | **CAT** | **End Term Exam (ETE)** | **Total Marks**  **(100)** |
| Theory | 10 | 15 | 25 | 50 |

**Compliance report**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **School of Basic and Applied Sciences** | | | | | | | | |
| **Programme** | | **B.Tech** | | | | | | |
| **Programme Chair** | |  | | | | | | |
| **Compliance report of course handout** | | | | | | | | |
| **Sl No** | **Course code** | | **Course title** | **Section** | **Taught by faculty** | **Course**  **coordinator** | **Course handout Submission date** | **Remarks by PC if any** |
| **1.** | BBS01T1008 | | Biology for engineers |  | **Pinki Chakraborty** | **Pinki Chakraborty** | **09/03/2022** |  |
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**Signature of PC; Signature of Dean:**

**Review by IQAC:**