# Syllabus: Chemistry-II
## For
## B.Tech. Biotechnology, Food Technology, Biomedical Engineering

| Effective from Session: 2024-25 | | | |
|---|---|---|---|
| **Course Code** | CH102 | **Title of the Course** | Chemistry-II |
| **Year** | First | **Semester** | Second |
| **Pre-Requisite** | 10+2 with Chemistry | **Credit** | 04 |
| **Course Objectives** | <ul><li>Adoptive curiosity and cultivate interest in chemistry.</li><li>Attain a comprehensive knowledge and understanding of Chemistry.</li><li>Improve an understanding for chemistry and its practical applications in everyday life.</li><li>Develop proficiency in solving qualitative and quantitative problems.</li><li>Enhance practical and technical skills.</li><li>Develop the ability to work effectively and safely in a laboratory environment.</li><li>Improve communication skills to effectively convey scientific concepts and findings.</li></ul> | | |

| Course Outcomes | |
|---|---|
| **CO1** | To study the fundamental concepts of inorganic chemistry including the prediction of geometry and shape of simple molecules and analyze the magnetic behaviour and stability of homo and hetero-nuclear diatomic molecules and different theories of acids and bases and pH. To study the structures, synthesis and uses of fullerenes, and graphite. To practically determine the strength of a given unknown solution and equivalent weight by chemical displacement method. |
| **CO2** | To understand the basic concepts of organic chemistry and reaction intermediates. To know and apply important phenomena like inductive effect and mesomeric effect etc. To practically identify the functional group of the given unknown organic compound. |
| **CO3** | To understand the fundamental concepts of molecular spectroscopy, with a focus on the interaction of electromagnetic radiation with molecules as well as the origin of electronic spectra. To know the basic principles of some important spectroscopic techniques and their applications. To practically understand the working of UV-visible spectrophotometer and determine the content of the given metal. |
| **CO4** | To study different polymers and their classification. To get acquainted with the synthesis and uses of some common polymers and laboratory synthesis of selected polymers. |
| **CO5** | To know the characteristics, composition and utility of different fuels and the working of bomb calorimeter. To know about the hardness in water and water softening processes for both temporary and permanent hardness and practical implementation of temporary and permanent hardness removal by complexometric titration, alkalinity and chlorine content in the water sample. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Chemical Bonding and Material Chemistry** | ***Theory***: Hybridization and geometry of simple molecules, VSEPR theory, Molecular orbital theory of homo and hetero diatomic molecules, theories of acids and bases, concept of pH and its measurement.<br>Graphite and fullerenes: Preparation, properties and applications.<br>***Practicals:***<br>1. To determine the strength of the given HCl solution by titrating it against NaOH solution using a pH meter.<br>2. To determine the Chloride content in the given water sample by Mohr's method. (Argentometric method). | 8 | 1 |
| 2 | **Basics of Organic Reaction Intermediates** | ***Theory***: Common functional groups, Reaction intermediates (carbocation, carbanion and free radicals), their structure and stability. Types of attacking reagents (electrophiles and nucleophiles), Types of Organic Reactions: Substitution reactions; electrophilic, & nucleophilic with examples. Inductive effect, electromeric effect, mesomeric effect and hyperconjugation.<br>***Practicals:***<br>1. Identification of functional group in the given organic compound<br>2. Element detection in organic compounds | 8 | 2 |
| 3 | **Spectroscopic techniques and their applications** | ***Theory:*** Molecular spectroscopy: Electromagnetic radiations and their characteristics. Basic principle, working and applications of UV, visible, IR, and $^1$H-NMR spectroscopic techniques for the determination of the structure of simple compounds.<br>***Practicals:***<br>1. To determine the iron concentration in the given water sample by Spectrophotometer using potassium thiocyanate as colour developing agent.<br>2. Identification of simple organic compounds by spectral analysis. | 8 | 3 |
| 4 | **Chemistry of Polymers** | ***Theory:*** Polymers and their classification, thermoplastic and thermosetting resins. Polyamides (Nylon-6, Nylon-6,6, Nylon-6,10, Nylon-11, Kevlar), Polyesters (Terelene), and Polyacrylates (PMMA, PAN, PVC), bakelite, conducting, and biodegradable polymers.<br>***Practicals:***<br>1. Synthesis of phenol formaldehyde resin<br>2. Synthesis of urea formaldehyde resin | 8 | 4 |
| 5 | **Fuel, and Water quality analysis** | ***Theory:*** Fuels: Classification of fuels, determination of gross and net calorific values using Bomb Calorimeter.<br>Water quality treatment: Hardness and alkalinity of water, softening of water by Lime-Soda process, Zeolites and ion exchange resins process, Reverse Osmosis. Treatment of boiler feed water by Calgon process.<br>***Practicals:***<br>1. To determine the temporary and permanent hardness in the given water sample by Complexometric titration using EDTA as the standard solution.<br>2. To determine the alkalinity of the given water sample. | 8 | 5 |

**Reference Books:**

Jain P. C. and Jain M. 1994. Engineering Chemistry. DanpatRai publishing company Pvt. Ltd., Delhi.

Bahl B.S, ArunBahl and Tuli B.D. 2007. Essentials of Physical Chemistry. S. Chand and Co. Ltd., Delhi.

Industrial Chemistry B.K.Sharma, Goel publishing house.

Fundamentals of Chemistry, R.L. Madan, S.Chand Publications

Fundamentals of Chemistry with Quantitative analysis-I, R.L. Madan., S. Chand Publications

Advance Practical Chemistry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, PragatiEdition.

**e-Learning Source:**

https://www.bing.com/videos/search?q=MO+diagram&&view=detail&mid=205AE2DEEABF42ACF824205AE2DEEABF42ACF824&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3DMO%2520diagram%26qs%3Dn%26form%3DQBVR%26%3D%2525eManage%2

https://www.bing.com/videos/search?q=phase+diagram+video&&view=detail&mid=D49B5109D6339097E40BD49B5109D6339097E40B&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dphase%2Bdiagram%2Bvideo%26FORM%3DHDRSC3

https://www.bing.com/videos/search?q=organic+reaction+mechanism&qpvt=organic+reaction+mechanism&FORM=VDRE

https://www.bing.com/videos/search?q=functinal+group+detection&&view=detail&mid=F232CD67537BBA0CC3EBF232CD67537BBA0CC3EB&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dfunctinal%2520group%2520detection%26qs%3Dn%26form%3DQBVR%26%3D%2525eManage

https://www.bing.com/videos/search?q=alkalinility+of+water+sample&qpvt=alkalinility+of+water+sample&view=detail&mid=7AF6506DB69D2C2F3EA37AF6506DB69D2C2F3EA3&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%

| PO-PSO CO | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | 1 | - | 2 | 3 | 2 | 3 |
| CO2 | 2 | 1 | 2 | - | - | 1 | - | - | - | 0 | - | 2 | 2 | 1 | 3 |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | 1 | - | 1 | 3 | 2 | 3 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 2 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | - | - | 1 | - | 2 | 3 | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | MT102 | **Title of the Course** | Mathematics-I in Bioengineering | **L** | **T** | **P** | **C** |
| **Year** | 1 | **Semester** | 1 | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | 10+2 | **Co-requisite** | | | | | |
| **Course Objectives** | | The purpose of this undergraduate course is to impart basic and key knowledge of Matrix Theory, Trigonometry, Analysis of Plain Geometry, Differential and integral Calculus. By using the principle of applied mathematics to obtain quantitative relations which are very important for higher studies. After successfully completion of course, the student will able explore subject into their respective dimensions. | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students will be able to Explain solution of simultaneous equations by Cramer's rule, to determine rank of matrix, find consistency of linear system of equations and applications of Cayley-Hamilton theorem. |
| **CO2** | Students will be able to study set theory, recognize difference of sets, Cartesian product, study of venn diagram, to explain solution of cubic equations by Cardon's method. |
| **CO3** | Students will be able to Classify T-ratios, explain allied and certain angles, Understand T-ratios of multiple, submultiples, solve cubic equations by Cardon's method. |
| **CO4** | Students will be able to define equation of straight line, angle between two lines, explain equation of second degree, locus of a point, define length of tangent circle, explain circle and its properties |
| **CO5** | Student will be able to understand differentiation, parametric differentiation, indefinite and definite integral with problems |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | Matrices and Determinants | Algebra, Determinant, properties of determinants, solution of simultaneous equations by Cramer's rule, Matrices, properties of matrices, linear dependence,Rank of matrix, consistency of linear equations, Solution of linear system of equations, characteristic equation, Cayley-Hamilton's theorem , eigen value and eigen vector. | 08 | CO1 |
| 2 | Set theory | Set theory, sets and their representations, Finite and infinite sets, subsets, empty set, Universal set, complement of a set, difference of sets, Venn diagram, ordered pairs, Cartesian product, solution of cubic equation by Cardon's method. | 08 | CO2 |
| 3 | Trigonometry | Measurement of angle, T-ratio, Addition, subtraction and transformation formula, T-ratios of multiple, submultiple, Allied and certain angles. | 08 | CO3 |
| 4 | Coordinate geometry-2D | Coordinate systems, distance between two points, area of triangle, Locus of a point, equation of straight line, slope and intercept form, General equation of first degree, angle between two lines, equation of parallel and perpendicular lines to given lines, Distance between two parallel lines, equation of second degree, circle, different forms of equation of circle, Equation of chord of contact, length of tangent circle. | 08 | CO4 |
| 5 | Calculus | Limits and functions, definition of differential coefficient, differentiation of standard functions, Function of function, parametric differentiation,Integration, indefinite integrals, integration by parts , Substitution and partial fraction form, evaluation of definite integrals. | 08 | CO5 |

| **Reference Books:** |
|---|
| 1. Mathematics:  NCERT |
| 2. Mathematics, R.D. Sharma |
| 3. Higher Engineering Mathematic: B. V. Ramana, Tata Mcgraw Hill Publishers |
| 4. Mathematic: R. S. Agarwal |
| 5.  Higher Engineering Mathematic:  B. S. Grewal, Khanna Publishers |

| **e-Learning Source:** |
|---|
| https://elearningk12.com |
| https://www.mdpi.com |
| https://www.mathisfun.com |

## Course Articulation Matrix: (Mapping of COs with POs and PSOs)

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

1-    **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

| Effective from Session: **2024-25** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | LN132 | **Title of the Course** | Communication Skills: Theory and Practices | **L** | **T** | **P** | **C** |
| **Year** | I$^{st}$ | **Semester** | I/I | 3 | 0 | 1 | 4 |
| **Pre-Requisite** | 10+2 | **Co-requisite** | Graduation | | | | |
| **Course Objectives** | ● The course aims to educate the students in the artistry and utility of the English language for professional purposes by studying language.<br>● The key component of the various types of professional communication is communication in English, which is now a global language.<br>● The Department of Languages caters to the needs of the students aspiring for training, expertise, and excellence in professional communication with a marked emphasis on English for Specific/Special Purposes (ESP). | | | | | | |

| | **Course Outcomes** |
|---|---|
| **CO1** | Students will be introduced to the basic understanding of communication and Professional Communication. Knowledge of Professional, cultural, and cross-cultural communication will be imparted. The meaning and process of communication, verbal and nonverbal communication will be focused.<br>A basic understanding of questions will be provided. They will also learn & practice how to introduce themselves in a professional setting & how to manage speaking anxiety. |
| **CO2** | Students will develop an understanding of the concept and theory of Lingua Franca ELF, Its Importance and its use as a means of communication between populations speaking vernaculars that are not mutually intelligible. Students will develop an understanding of IPA symbols and improve pronunciation through practice |
| **CO3** | Basic tools of communication and improvement in communicative competence. Oral Communication techniques through situational conversations. |
| **CO4** | Understanding the structural and functional grammar and basic structure of language. Students will also develop the ability for group discussion and debate. |
| **CO5** | Enhancement of writing skills in English i.e., writing applications, reports, and various types of letters. Preparing PowerPoint Presentations and practicing for oral presentations to develop competency-based professional skills. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Professional Communication** | Professional Communication: It's Meaning and Importance, Essentials of Effective Communication, Barriers to Effective Communication. (Theory) | 6 | **CO 1** |
| | | **Lab-1**<br>Introduction (SWOT Analysis)<br>Framing Questions (Yes/No Questions, Why-Questions, Question tags, Rhetorical Questions) | 2 | |
| 2 | **Oral Communication Skills (Speaking Skills)** | English as Lingua Franca: From Theory to Practice<br>Importance of Spoken English<br>Status of Spoken English in India (Theory) | 6 | **CO 2** |
| | | **Lab-2**<br>International Phonetic Alphabets (IPA) Symbols<br>Spelling and Pronunciation (Practical) | 2 | |
| 3 | **Basic Vocabulary** | Euphemism, One-word Substitution, Synonyms, Antonyms, Homophones, Idioms and Phrases, Common Mistakes, Confusable Words and Expressions, Portmanteau Words, Foreign Words and Expressions. (Theory) | 6 | **CO 3** |
| | | **Lab-3**<br>**Oral Communication Practice**: - Asking for and giving information<br>Congratulating people on their success<br>Expressing condolences<br>Apologizing and forgiving (Practical) | 2 | |
| 4 | **Basic Grammar** | Articles, Prepositions, Tenses, Concord, (Subject-Verb agreement), Modal Auxiliaries, Verbs: its Kinds and uses, Degrees of Comparison, Punctuation. (Theory) | 6 | **CO 4** |

| | | | | |
|---|---|---|---|---|
| | | **Lab-4**<br>**Oral Practice:**<br>Group Discussion (Based on Topic and Case Study)<br>Debate (Topic Based)<br>(Practical) | **2** | |
| 5 | **Basic Composition** | Report Writing: What is report? Kinds and Objectives of reports, writing reports, Business Letter writing; Introduction to Business Letters, Layout of Business letters, Letters of Enquiry/Complaint Proposal writing. (Theory) | **6** | **CO 5** |
| | | **Lab-5**<br><br>Oral Presentation through PPT<br>(Topic based)<br>(Practical) | **2** | |

**Reference Books:**

1. Gerson, Sharon J. *Technical Writing: Process and Product* (5th edition). Prentice Hall, 2005.

2. K. Floyd, *Interpersonal Communication: The Whole Story*. McGraw Hill, 2009.

3. Greenbaum, Sidney and Nelson Gerald, *An Introduction to English Grammar*. Routledge, 2009.

4. Swan, Michael, *Practical English Usage*. OUP, 2005.

5. Murphy, Raymond. *English Grammar in Use*. Cambridge University Press, 2019.

6. Kumar, Sanjay and Pushp Lata., Communication Skills. Oxford University Press, Oxford 2011.

7. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principals and Practice. Second Edition, Oxford University Press, 2012.

8. Gerson, Sharon J. *Technical Communication: Process and Product* (9th edition). Longman Pub., 2016.

**e-Learning Source:**

1. http://www.uptunotes.com/notes-professional-communication-unit-i-nas-

2. https://www.docsity.com/en/subjects/professional-communication/

3. https://lecturenotes.in/download/note/22690-note-for-communication-skills-for-profession...

**Course Articulation Matrix: (Mapping of COs with POs and PSOs)**

| PO-PSO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | P011 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | - |
| CO2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | - |
| CO3 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | - |
| CO4 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - |
| CO5 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| Effective from Session: 2024-25 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BE101 | **Title of the Course** | Introduction to Bioengineering | **L** | **T** | **P** | **C** |
| **Year** | I | **Semester** | I | 2 | 0 | 0 | 2 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | |
| **Course Objectives** | The objective of this paper is to provide a comprehensive introduction to bioengineering, encompassing the fundamental principles of biotechnology and study of biological systems and biomolecules, and an overview of the general applications of bioengineering in various fields. | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Define and understand the basics of biotechnology and its branches, assess current research and institutions in India, and distinguish between microbial, plant, and animal cell systems for practical and research applications. |
| **CO2** | Analyze and evaluate the structures and functions of key biological molecules and apply this knowledge to understand their roles in biological systems. |
| **CO3** | Assess and integrate information on biotechnology applications in various sectors and analyze contemporary challenges, benefits, and success stories, with a focus on emerging biotech startups. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to Biotechnology & Biological Systems** | Biotechnology: Introduction, Principles and Processes; Branches of Biotechnology Biotechnology Research in India; Biotechnology Institutions in India (Public and Private Sector); Biological Systems: Microbial cell, Plant Cell and Animal Cell | 8 | CO1 |
| 2 | **Introduction to Biomolecules** | Biomolecules: Structure and function of Macromolecules (Carbohydrates, Proteins, Lipids, Nucleic acid). Introduction, classification and nomenclature of enzymes. | 8 | CO2 |
| 3 | **General Applications Of Bioengineering** | Application in Health, food, medicine, agriculture and environment; Genetically modified (GM) organisms, Pros and Cons. Current challenges and success stories/startups in Biotechnology | 8 | CO3 |

**Reference Books:**

1. Text book of Biotechnology by H.K.Dass (Wiley India publication), , 5th Edition (2017)
2. Biotechnology by B.D.Singh (Kalyani Publishers). Latest Edition (2021)
3. Essential Cell Biology by Alberts. (WW Norton & Co; Sixth International Student Edition) 6th Edition (2023)
4. Introduction to Biotechnology by William J. Thieman, Michael A. Palladino, Publisher: Benjamin Cummings 2) 4th Edition (2018)
5. Lehninger Principles of Biochemistry, 8th Edition (2021)

**e-Learning Source:**

1. http://www.digimat.in/nptel/courses/video/121106008/L10.html
2. https://archive.nptel.ac.in/courses/104/102/104102016/

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PO-PSO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 1 | 3 | 3 | | | | | 2 | 3 | 3 | 3 |
| **CO2** | 2 | 1 | 1 | 1 | 1 | | | | | | 2 | 3 | 1 | |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 3 | 3 | | | | 2 | 3 | 3 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

**Attributes & SDGs Common for all branches/Disciplines**

| Course Code | Course Title | Attributes | | | | | | | SDGs No. |
|---|---|---|---|---|---|---|---|---|---|
| ES102 | Concept of Environmental Studies | Employability | Entrepreneurship | Skill Development | Gender Equality | Environment & Sustainability | Human Value | Professional Ethics | |
| | | | | | | √ | | | **SDGs 6,13,14,& 15** |

| Effective from Session: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **ES102** | | **Title of the Course** | Concept of Environmental Studies | **L** | **T** | **P** | **C** |
| **Year** | I | | **Semester** | I/II | 2 | 1 | 0 | 3 |
| **Pre-Requisite** | 10+2 | | **Co-requisite** | | | | | |
| **Course Objectives** | | The objectives of environmental studies are Creating awareness about environmental problems among people and imparting basic knowledge about the environment and its allied problems. The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, loss of forget, solid waste disposal, degradation of the environment, issues like economic productivity and national security, Global warming, the depletion of the ozone layer and loss of biodiversity have made everyone aware of environmental issues | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | Students will be able to **understand** about relationship between Humans and Environment |
| CO2 | **Understand** about Ecosystem, Biodiversity and Conservation |
| CO3 | **Identifying** environmental pollution, its impact on humans, ecosystems and control measures through latest technologies |
| CO4 | **Analyze** and **apply** knowledge for understanding complex environmental- economic-social challenges, and active participation in solving current environmental problems and preventing the future ones |
| CO5 | **Evaluate** the Environmental crisis and can propose effective environmental management |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Unit I. Humans and the Environment** | The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. The emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers) | 06 | CO1 |
| 2 | **Unit II. Natural Resources, Ecosystem and Biodiversity** | Overview of natural resources: Definition, Classification and types of natural resources; Status and challenges. Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots. Major ecosystem types in India and their basic characteristics; Ecosystem services-classification and their significance. Threats to biodiversity and ecosystems, Major conservation policies: in-situ and ex-situ conservation approaches. | 10 | CO2 |
| 3 | **Unit III. Environmental Pollution and International Treaties** | Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources; Primary and secondary pollutants; Indoor air pollution; National Ambient Air Quality Standards. Technology to mitigate air pollution Water pollution: Sources; River, lake, and marine pollution, groundwater pollution; Water quality parameters and standards; Technology to mitigate water pollution Soil pollution and solid waste; Solid and hazardous waste; Technology to mitigate waste pollution Noise pollution: Definition; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; Technology to mitigate noise pollution Thermal and Radioactive pollution: Sources, impacts and Technology to mitigate pollution | 10 | CO3 |
| 4 | **Unit IV. Climate Change: Impacts, Adaptation and Mitigation** | Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure, Indigenous knowledge for adaptation to climate change. Major International Environmental Agreements: CBD; Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; CITES; Ramsar Convention; UNCCD; Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol and the Kigali Amendment; Basel Convention; Stockholm Convention; Minamata Convention; UNFCCC; Kyoto Protocol; Paris Agreement; India's status as a party to major convention. Major Indian Environmental Legislations, Industry-specific environmental standards; Waste management rules; National Green Tribunal; Some landmark Supreme Court judgments | 10 | CO4 |
| 5 | **Case Studies and Field Work** | • Discussion on one national and one international case study related to the environment and sustainable development. • Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report. • Documentation of campus biodiversity. • Campus environmental management activities such as solid waste disposal, water management, and sewage treatment. • Model Making | 09 | CO5 |

| Reference Books: |
|---|
| 1) Agarwal, K.C. 2001 Environmental; Biology, Nidi Pub. Ltd. Bikaner. |
| 2) Bharucha Erach, The Biodiversity of India, Mapin Pub. Pvt. Ltd., Ahemdabad-380, India. |
| 3) Brunner R.C. 1989. Hazardous waste incineration, Mc Graw Hill |
| 4) Clark R.S. Marine Pollution, Clanderon Press Oxford (TB) |

| e-Learning Source: |
|---|
| https://byjus.com/biology/difference-between-environment-and-eCOsystem. |
| https://www.youtube.com/watch?v=dRPl4TB8w7k |

| PO- PSO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
| CO1 | - | - | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | | |
| CO2 | - | - | 1 | - | - | - | 3 | - | 1 | - | - | - | - | - | 1 | 1 | | |
| CO3 | - | - | 2 | - | - | - | 3 | - | 1 | - | - | - | - | - | 1 | 1 | | |
| CO4 | - | - | 2 | - | - | - | 2 | - | 1 | - | - | - | - | - | 1 | 1 | | |
| CO5 | - | - | 1 | - | - | - | 2 | - | 1 | - | - | - | - | - | 1 | 1 | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HOD** |

# Integral University, Lucknow

| Effective from Session: 2025-26 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | ME101 | **Title of the Course** | Basic Mechanical Engineering & Workshop | **L** | **T** | **P** | **C** | |
| **Year** | I | **Semester** | I / II | **3** | **0** | **2** | **4** | |
| **Course Objectives** | To impart knowledge to the students of basic thermodynamic processes and laws, along with mechanics of materials, their properties and fabrication techniques | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Understand the basic concepts of thermal sciences and temperature measurement on the basis of zeroth law of thermodynamics |
| **CO2** | Understand and apply first and second law of thermodynamics in various processes and systems |
| **CO3** | Will be able to model the problem using free-body diagrams and reach to solution by using equilibrium equations |
| **CO4** | Will be able to perform structural analysis for safe design and fabrication techniques |
| **CO5** | Will be able to understand mechanical properties of engineering materials, their testing and different operations performed in workshop to make components |
| **CO6** | Learn to perform operations on lathe machine shop, fitting shop, carpentry shop |
| **CO7** | Learn to perform operations on sheet metal shop, smithy shop, welding shop |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Fundamental Concepts for modelling of thermal systems** | Role of thermodynamics in different fields of engineering, thermodynamics system, surrounding and universe, macroscopic & microscopic point of view, concept of continuum, thermodynamic equilibrium, property, state, path, process, Energy and its form, temperature and it's measurement, Zeroth law of thermodynamics. | 08 | CO1 |
| 2 | **First law & Second law of thermodynamics as a tool for analysing thermal systems** | First law of thermodynamics and its application for non flow processes, Flow processes and control volume, Flow work, Steady flow energy equation, Mechanical work in a steady flow process. Essence of second law of thermodynamics, Thermal reservoir, heat engines, COP of heat pump and refrigerator and its introduction to industrial applications. Statements of second law, Carnot cycle, Clausius inequality and its applications. | 08 | CO2 |
| 3 | **Introduction to engineering mechanics and its application** | Role of engineering mechanics in different fields of engineering, Laws of motion, Transfer of force to parallel position, Resultant of planer force system. Free Body diagrams, equilibrium and its equation, Coulomb's law of friction, Equilibrium of bodies involving dry friction. | 08 | CO3 |
| 4 | **Structure analysis for safe design** | Beams: Introduction, its types and uses in engineering application, concept of shear force and bending moment, Shear and bending moment diagram for statically determinate beams. Simple Stress and strain: Introduction, Normal & shear stress-strain for unidirectional loading, pure bending of beam and its applications. | 08 | CO4 |
| 5 | **Mechanical properties and testing of engineering materials** | Introduction to engineering materials & their applications, Mechanical properties of engineering materials. Mechanical Testing: Tensile and compressive test, stress-strain diagrams for ductile and brittle materials, bending test, hardness test and impact test. | 08 | CO5 |

| Practical | | | | |
|---|---|---|---|---|
| S. No. | Name of shop | List of experiments | Contact Hrs. | Mapped CO |
| 1 | **Machine shop** | To study and sketch a lathe machine<br>To perform facing, plain turning, step turning, taper turning & chamfering operations | 4 | CO6 |
| 2 | **Fitting shop** | To perform step cutting, filing, drilling & tapping<br>To make a 90° v-groove fitting on mild steel flat | 4 | CO6 |
| 3 | **Carpentry shop** | To make a mortise and tenon joint<br>To make a corner lap joint | 4 | CO6 |
| 4 | **Smithy shop** | To make a square punch from mild steel round rod<br>To make a pipe hook from a mild steel round rod | 4 | CO7 |
| 5 | **Welding shop** | To weld the two given plates & make a lap joint (by arc welding)<br>To weld the two given plates & make a butt joint (by arc welding) | 4 | CO7 |
| 6 | **Sheet metal** | To perform different fabrication operations in sheet metal shop | 4 | CO7 |

**Reference Books:**

◆ Van Wylen G.J. & Sonnlog R.E. Fundamentals of Classical Thermodynamics, John Wiley & Sons, Inc. NY
◆ Wark Wenneth: Thermodynamics (2nd edition) Mc Graw Hill Book Co. NY
◆ Holman, J.P.: Thermodynamics, Mc Graw Hill Book Co.NY
◆ Shames I.H., Engineering Mechanics, P.H.I
◆ Kumar D.S, Mechanical Engineering, S.K. Katarial & Sons
◆ Bhavi Katti S.S., Engineering Mechanics, New Age Pub
◆ Bharti P.K: Engineering Mechanics, Kataria and Sons
◆ Callister W. D., 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India
◆ Khurmi R.S, Workshop Technology, S.Chand Publication

**e-Learning Source:**

https://www.youtube.com/watch?v=Dy2UeVCSRYs&list=PL2_EyjPqHc10CTN7cHiM5xB2qD7BHUry7

**Course Articulation Matrix: (Mapping of COs with POs and PSOs)**

| PO-PSO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | | 2 | | | | | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | | 3 | | | | | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | | 3 | | | | | 3 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 2 | | 3 | | | | | 3 | 3 | 2 | 1 |
| CO5 | 3 | 3 | 2 | 1 | | 3 | | | | | 3 | 3 | 2 | 2 |
| CO6 | 3 | 1 | | 2 | | 2 | | 2 | | | 3 | 3 | 3 | 3 |
| CO7 | 3 | 1 | | 2 | | 2 | | 2 | | | 3 | 3 | 3 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HOD** |

| Effective from Session:2024-25 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | **HM101** | **Title of the Course** | **RASHTRA GAURAV** | **L** | **T** | **P** | **C** |
| **Year** | **I** | **Semester** | **I** | **2** | **0** | **0** | **0** |
| **Pre-Requisite** | Intermediate (Any Stream) | **Co-requisite** | None | | | | |
| **Course Objectives** | The objective of the course on "Rashtra Gaurav" is to explore and critically analyze the multifaceted dimensions of national pride and glory, as depicted in the paper. Participants will delve into the historical, cultural, social, and political aspects that contribute to the concept of "Rashtra Gaurav" (National Pride) in the context of the specific themes and perspectives presented in the paper. Through in-depth discussions, readings, and interactive sessions, participants will gain a comprehensive understanding of the factors that shape and define a nation's sense of pride, and how these factors influence individual and collective identities. The course aims to foster a nuanced appreciation for the significance of "Rashtra Gaurav" in contemporary society, encouraging participants to critically evaluate its implications and applications within diverse global contexts. | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | To understand the basics of Indian Society and culture. |
| **CO2** | To understand the literature, science and astrology. |
| **CO3** | To understand Indian heritage. |
| **CO4** | To examine the philosophical and spiritual developments in India. |
| **CO5** | To evaluate the contributions of Major National Characters and Personalities. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | Indian Society & Culture | • Unity in Diversity: Cultural & Religious Harmony<br>• Indian Diaspora<br>• Ancient Indian Civilization.<br>• National and International Awards & Awardees | 05 | 01 |
| 2 | Literature, Science, Astrology | • Indian Epics: Ramayan & Mahabharata<br>• Prominent litterateur: Shudrak, Kalidas, Amir Khusru,<br>• Kautilya's Arthashastra<br>• Panini's Ashtadhyayi | 05 | 02 |
| 3 | Indian Heritage | • Cultural Heritage in India: Buddhist Monuments at Sanchi, Ajanta & Ellora Caves, Khajuraho, Taj Mahal<br>• Tourist Places in India: Red Fort, Ambar Palace, Kaziranga National Park | 04 | 03 |
| 4 | Philosophical and Spiritual Developments | • Sufism & Bhakti Movement:Bulleh Shah, Data Ganj Baksh, Khwaja Moinuddin Chishti, and Nizamuddin Auliya.Tulsidas, Surdas, Meera, Nanak & Kabir<br>• Jainism: Mahavir's Biography and Education<br>• Buddhism: The life of Buddha, Contributions of Buddhism to India's Culture | 05 | 04 |
| 5 | Major National Characters And Personalities | • Ashoka the Great and His Dhamma<br>• Raja Ram Mohan Roy& Brahmo Samaj<br>• Swami Vivekanand and his philosophies<br>• Mahatma Gandhi: Role of Gandhi in Indian National Movement<br>• Dr. Bhimrao Ambedkar: A Chief architect of the Indian Constitution | 06 | 05 |

**Reference Books:**

Jawaharlal Nehru - "The Discovery of India"
B.R. Ambedkar - "Annihilation of Caste"
Ramachandra Guha - "India After Gandhi: The History of the World's Largest Democracy"
Mahatma Gandhi – "My Experiment with Truth"
S C Dubey- "Indian Society"
Nadeem Hasnain –"Indian Society and Culture"
G Shah- "Social Movements in India"

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | **PO1** | **PO2** | **PO3** | **PO4** | **P05** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 |
| **CO2** | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 1 |
| **CO3** | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 |
| **CO4** | 1 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 1 | 3 |
| **CO5** | 2 | 3 | 1 | 2 | 2 | 3 | 1 | 3 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign and seal of HoD** |

# Syllabus: Physics for Bioengineering
## For
## B.Tech. Biotechnology, Food Technology, Biomedical Engineering

| Effective from Session: | | | |
|---|---|---|---|
| **Course Code** | PY102 | **Title of the Course** | Physics for Bioengineering |
| **Year** | First | **Semester** | Second |
| **Pre-Requisite** | 10+2 with Physics | **Credit** | 04 |
| **Course Objectives** | The purpose of this undergraduate course is to impart basic knowledge of fundamental concept of physics which is necessary for a strong engineering knowledge base and to support this knowledge through its various experiments. | | |

| Course Outcomes | |
|---|---|
| **CO1** | Explain and apply the principles of interference and diffraction to determine the wavelength of light using different optical instruments. |
| **CO2** | Analyse optical activity and the working principles of lasers for their application in science and technology. |
| **CO3** | Explain quantum phenomena such as blackbody radiation, photoelectric effect, and wave mechanics, and apply Schrodinger's equation to simple systems. |
| **CO4** | Analyse the principles and working of electron microscopes and interpret molecular spectra including rotational, vibrational, and Raman spectra for structural determination. |
| **CO5** | Classify solid-state materials based on structure and properties, apply X-ray diffraction principles for crystal analysis, and evaluate nanotechnology techniques and their applications. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Wave Optics** | ***Theory***: Coherent sources, Fresnel's biprism, thin film interference, Newton's ring, Fraunhoffer's diffraction at single slit, Fraunhoffer's diffraction at N-Slits (grating)<br>***Practicals:***<br>1. To determine the wave length of monochromatic light with the help of Fresnel's Biprism.<br>2. To determine the wave length of monochromatic light by Newton's ring.<br>3. To determine the wavelength of prominent spectral lines by plane diffraction grating. | 8 | 1 |
| 2 | **Polarization and Laser** | ***Theory***: Types of Polarised light, Brewster Law and Malus Law, Double refraction, Nicol prism, Optical activity, polarimeter Characteristics of laser beam, Main components of laser, Einstein's coefficients, He-Ne laser<br>***Practicals:***<br>1. To determine the specific rotation of cane sugar solution using Half Shade polarimeter.<br>2. To determine the refractive index of a liquid using laser. | 8 | 2 |
| 3 | **Quantum Physics** | ***Theory:*** Black body radiation (Qualitative discussion only – Stefan's law, Wein's law, Rayleigh-Jean's law, Planck law). Photoelectric Effect and Compton Effect, de-Broglie Hypothesis, Heisenberg's uncertainty principle (no derivation) and its applications (non-existence of electron in nucleus), Wave function and its physical admissibility, orthogonality of wavefunctions, normalization of wave functions, Schrodinger's equation and its application (particle in one dimensional potential box).<br>***Practicals:***<br>1. To determine the value of Planck's Constant using LEDs.<br>2. To verify Stefan's law by electrical method. | 8 | 3 |
| 4 | **Instrumentation and Elementary Molecular Spectroscopy** | ***Theory:*** Electron microscope: Principle and its working of SEM and TEM, Region of electromagnetic spectrum, Discrete set of energies of a molecule, electronic, vibrational and rotational energies. Quantization of vibrational energies, pure vibrational spectra. Quantization of rotational energies, pure rotational spectra. Rotational-Vibrational spectra; Raman Scattering<br>***Practicals:*** 1. To demonstrate the quantization of energy levels using Frank-Hertz Experiment | 8 | 3 |
| 5 | **Solid State Physics and Nanotechnology** | ***Theory: Solid State Physics:*** Classification of materials, Introduction to crystal structure (Lattice, basis, unit cell, lattice parameters for SC, BCC and FCC lattices) Seven crystal systems and fourteen Bravais lattices, Miller indices, Origin of X-rays (Continuous and Characteristic), Bragg's law, Moseley's law.<br>**Magnetic Properties:** Types of magnetic materials, Phenomena of hysteresis and its applications.<br>**Nanotechnology:** Introduction to nanotechnology and its applications, Nanostructure formation techniques (CVD, sputtering)<br>***Practicals:***<br>1. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.<br>2. To determine the energy band gap of a semiconductor using a PN junction diode. | 8 | 4 |

## Reference Books:

1. Fundamentals of Optics by Jenkins and White.
2. Concepts of Modern Physics by Arthur Beiser.
3. Fundamentals of Molecular Spectroscopy by C.N. Banwell, TMH Pub.
4. Molecular Structures and Spectroscopy by G. Herzberg.
5. Quantum Physics by Eisberg.
6. Introduction to Nanotechnology by Poole Owens, Wiley India.
7. Solid State Physics by S.O. Pillai, New Age Publications
8. Practical Physics. by R. K. Shukla, New Age International Private Limited; Third edition.
9. B.Sc. Practical Physics by Harnam Singh and Hemne, S. Chand and Company.
10. B. Sc. Practical Physics by CL Arora, S Chand and Company
11. Practical Physics by Kumar P.R.S., Prentice Hall India Learning Private Limited
12. Engineering Physics Practical by S.K. Gupta, Krishna Prakashan

## e-Learning Source:

https://nptel.ac.in/courses/115/101/115101011/

https://nptel.ac.in/courses/115/107/115107095/

https://nptel.ac.in/courses/113/106/113106093/

https://nptel.ac.in/courses/115/101/115101107/

https://youtu.be/fWhgguWc8rk

https://youtu.be/Bf0Tg-fNWjQ

https://youtu.be/dDp_Insp_p0

https://youtu.be/N0lxwqANsd4

https://youtu.be/G8Rqd2HNhuk

https://youtu.be/7Mq4isproEE

https://youtu.be/G8Rqd2HNhuk

https://youtu.be/NtfbmAw62Hw

| PO-PSO CO | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | | 2 | 2 | | | | 1 | | 1 | 1 | 1 | |
| CO2 | 3 | 2 | | | 2 | 1 | | | 1 | | 1 | 1 | 1 | |
| CO3 | 3 | 2 | | | | | | | | | | 1 | | 1 |
| CO4 | 3 | 2 | | 2 | 2 | | | | | | 1 | 1 | | 2 |
| CO5 | 3 | | | 2 | 2 | 1 | | 1 | | | 1 | 1 | | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| | |
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| Effective from Session: 2025-26 (NEP) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CS101 | **Title of the Course** | Computer Programming | **L** | **T** | **P** | **C** |
| **Year** | I | **Semester** | II | 3 | 0 | 2 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | |
| **Course Objectives** | • To give knowledge of computers, networks, algorithms & flowcharts.<br>• To provide fundamental concepts of programming language 'C'.<br>• To show the use of functions and pointers to different problems.<br>• To study the implementation of arrays, matrices and strings.<br>• To give concepts of user defined datatypes, structure & union | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Understanding basic concepts of computer, networks and formulation of algorithmic solutions to problems. |
| **CO2** | Understanding of programming concepts of C language and their implementation. |
| **CO3** | Analyze and develop programs on pointers and functions. |
| **CO4** | Acquire the knowledge and develop programs on different operations on arrays, matrices & strings. |
| **CO5** | Implementation of programs on structure, union & dynamic memory allocation. |

## THEORY

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to Computers** | Generation of computers, Characteristic and classifications of computers. Components of Computer: CPU, Various I/O Devices, Memory & its types, (Memory Hierarchy, Storage Media), Computer Software and their types, Operating System. Computer Networks & Communication: LAN, MAN, WAN, Network Topologies, Modes of Data Communication. Introduction to Internet and its Safeguard: Internet Addresses, Domain Name System, URL, Web Browsers Search Engines, Translators, Firewalls, Anti-Virus. Algorithm and flowchart: Algorithm and flow chart characteristics, Sketching Flowcharts of various problems. | 9 | 1 |
| 2 | **Introduction to C** | Standard I/O in 'C', 'C' Fundamental, C Character set, Constants, Variables, Keywords and Identifiers, Data types, Declaration. Operators and Expressions, Conditional statements (If, If-else), Nesting of if- else statement, switch statement, The? operator, goto statement. Decision making and Looping (While, Do-While, for), Break and Continue statements, Case Control Structures (Switch), C programs based on above concepts. | 8 | 2 |
| 3 | **Pointers & Functions** | Declaration and initialization of pointers, accessing the address of the variable, accessing the variable through the pointer, chain of pointers, pointers operators, pointer arithmetic Introduction to Functions: Need of "C" function, User Defined and Library Functions, Prototype of Function, Call by Value; Call by Reference; Nesting of Functions, Recursion. Pointers with function, C program based on above concept. | 9 | 3 |
| 4 | **Array** | Concept of One Dimensional and Multi-Dimensional arrays, Declaration, Operations: insert, delete, search, traverse, and merge, matrix operations, Sorting: Bubble sort, merge sort, insertion sort. Character array and strings: declaring and initializing strings variable, reading and writing a character, reading and writing strings from terminal, Arithmetic operations on characters, string handling functions. Application of pointers, and function on array, C program based on above concept. | 10 | 4 |
| 5 | **Structures** | Defining Structure, Declaration of Structure Variable, Accessing Structure members, copying and comparing structure variable, operation on individual member, nesting of structures, Array of structures. Application of pointers and function on Structures. Union Defining Union Declaration of Union, difference between structure and Union, Introduction of Static and Dynamic memory allocation- The process of Dynamic memory allocation, C program based on above concept. | 8 | 5 |

## PRACTICAL

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Write a Program to print sum and multiply of two numbers. | 2 | 1 |
| 2 | WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard. | 2 | 1 |
| 3 | Write a Program to enter the temperature in Celsius(c) then count it into Fahrenheit. | 2 | 1 |
| 4 | Write a Program to swap the number taking the help of third variable. | 2 | 1 |
| 5 | Write a Program to convert Decimal to Binary in C. | 2 | 1 |
| 6 | Write a Program to find the greater number enter by user. | 2 | 2 |
| 7 | Write a Program to check a year is leap year not. | 2 | 2 |
| 8 | Write a Program to print number is even or odd. | 2 | 2 |
| 9 | Write a C program to design calculator with basic operations using Switch case. | 2 | 2 |
| 10 | Write a Program to print the no is positive or negative. | 2 | 2 |
| 11 | Write a C program to print Fibonacci Series without using Recursion and using Recursion. | 2 | 3 |

| 12 | WAP to find a Factorial in C. | 2 | 3 |
|---|---|---|---|
| 13 | Write a Program to enter any no and check whether the given no is palindrome or not. | 2 | 3 |
| 14 | Write a Program to enter any no. and check whether the given no. is Armstrong or not. | 2 | 3 |
| 15 | Write a Program to Print Pattern<br>*<br>* *<br>* * *<br>* * * * | 2 | 3 |
| 16 | Write a Program to Print<br>Pattern1 2 3 4<br>1 2 3<br>1 2<br>1 | 2 | 3 |
| 17 | Write a C program to form Pascal Triangle using numbers. | 2 | 3 |
| 18 | Write a program to find in C to design the report card of 5 subject according to the following condition if the totalpercentage are.<br>>=35 and <45    III Div<br>>=45 and <60    II Div<br>>=60              I Div<br>If any students score <35 in any of the subject display fail | 2 | 3 |
| 19 | Write a Program to create 2-D array or order M*N and insert the element and display it. | 2 | 4 |
| 20 | Write a Program to find the addition of two matrix of order M*N. | 2 | 4 |
| 21 | Write a Program to find the Transpose of the matrix. | 2 | 4 |
| 22 | WAP to find Reverse of an Array using Functions in C. | 2 | 4 |
| 23 | Write a Program to swap two number using function pointers. | 2 | 5 |
| 24 | WAP to demonstrate Student Record System in C. | 2 | 5 |

**Reference Books:**

1. Foundation of Information Technology by 'D.S. Yadav'- New age International

2. Programming in 'C' by 'E Balagurusamy'. -TMH Publication.

3. Let us 'C' by 'Yashwant Kanitkar'-BPB Publication.

4. The C Programming Essentials by Dey- Pearson Publication.

**e-Learning Source:**

https://onlinecourses.nptel.ac.in/noc22_cs40/preview

https://archive.nptel.ac.in/courses/106/104/106104128/

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PO-PSO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 1 | 2 | | | | | | | 2 | 3 | 1 | 1 |
| CO2 | 3 | 3 | 1 | 1 | | | | | | | 2 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 2 | | | | | | | 2 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 2 | 1 | | | | | | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 1 | | | | | | 1 | 3 | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Integral University, Lucknow

| Effective from Session: 2024-25 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | BE103 | **Title of the Course** | Thermodynamics | | **L** | **T** | **P** | **C** |
| **Year** | I | **Semester** | II | | **2** | **1** | **0** | **3** |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | In this course, students learn how to apply knowledge of the laws of thermodynamics, chemistry, physics, and engineering to analyze and solve physical and chemical problems encountered in chemical and biochemical engineering. The course gives the student the opportunity to analyze and interpret data, to identify, formulate, and solve engineering problems, and to use the techniques, skills, and modern engineering tools necessary for engineering practice | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Understand the theoretical concepts of thermodynamics and Evaluate its application to energy conversion in technological applications. |
| **CO2** | Understand and identify the concept of reaction mechanism of fluids and their energy calculation with the help of different thermodynamic models. |
| **CO3** | Calculate and evaluate the equilibrium conversion for single and multiple reactions and analyze the effect of different parameters on equilibrium constant. |
| **CO4** | Apply and Analyze the Application of Thermodynamics in biotechnology and food technology processes. |

| Unit No. | Title | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction of thermodynamic properties** | Systems, surroundings, processes, properties (extensive/intensive), closed and open systems based on the number of components, First Law of thermodynamics, a generalized balance equation and conserved quantities, Volumetric properties of fluids exhibiting non ideal behavior; residual properties. | 8 | CO1 |
| 2 | **Thermodynamic properties of fluids** | Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models. | 8 | CO2 |
| 3 | **Chemical Reaction equilibria** | Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions. | 8 | CO3 |
| 4 | **Applications of thermodynamics** | Thermodynamics: binding between biomolecules, such as proteins, nucleic acids, and small molecules; productivity of microbial cell. food processing; preservation; Thermal properties of food material. | 8 | CO4 |

| Reference Books: |
|---|
| Smith J.M., Van Ness H.C., and Abbot M.M. "Introduction to Chemical EngineeringThermodynamics", 6th Edition. Tata McGraw-Hill, 2003. |
| Narayanan K.V. "A Text Book of Chemical Engineering Thermodynamics",PHI,2003. |
| Christiana D. Smolke, " The Metabolic Pathway Engineering Handbook Fundamentals",CRC Press Taylor & Francis Group, 2010. |
| Sandler S.I. "Chemical and Engineering Thermodynamics", John Wiley,1989 |

| e-Learning Source: |
|---|
| https://www.youtube.com/watch?v=iHHqMZq--sU |
| https://www.youtube.com/watch?v=hPnnBlz2UVM&list=PLs4gWo79plOI8qKWtqtRuZ5ZhUmFFtxaC |

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 1 | 2 | 1 | 2 | 1 | 1 | | | 1 | 3 | 3 | 1 |
| **CO2** | 3 | 2 | 1 | 1 | 1 | 1 | | | | | 1 | 3 | 2 | 1 |
| **CO3** | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | | 3 | 3 | |
| **CO4** | 3 | 3 | 1 | 1 | 1 | 1 | | 2 | | | 1 | 3 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| | |
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

**Integral University, Lucknow**

| Effective from Session: 2024-25 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BE104 | **Title of the Course** | IPR, Biosafety, and Bioethics | **L** | **T** | **P** | **C** |
| **Year** | I | **Semester** | II | 2 | 1 | 0 | 3 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | |
| **Course Objectives** | The course has been designed to acquaint the students with the basic concepts of IPR, biosafety, and bioethics, their significance and applications. | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | **Define** Intellectual Property Rights (IPR), **describe** its types (patents, copyrights, trademarks, trade secrets, geographical indications, industrial designs), **explaining** their significance in protecting innovation and intellectual assets. |
| **CO2** | **Define**, **understand**, and **analyze** the IPR related agreements and treaties and the concept of Technology Transfer. |
| **CO3** | **Identify** biosafety issues and **explain** the classification of Biological Safety Cabinets and biosafety levels (BSL-1 to BSL-4). **Analyze** containment regulations for biohazards and the role of regulatory agencies like GEAC and RCGM |
| **CO4** | **Explain** the principles of bioethics in biotechnology, including medical bioethics and ethical dilemmas in treatment. **Evaluate** the legal, ethical, and social implications of bioethics in biotechnology, making recommendations for resolving dilemmas in biotechnological practices. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to Intellectual Property** | Basic concepts and history of Intellectual Property Rights (IPR), Types of IPR- Patent, Copyright, Trade Marks, Geographical Indications, Trade secrets, Industrial Designs, Protection of Traditional Knowledge (TK) in IPR, Significance of IPR. | 8 | CO1 |
| 2 | **Agreements and Treaties related to IPR and TT** | Indian Patent Act, WIPO, GATT, WTO, TRIPS Agreement, Patent Cooperation Treaty, Infringement, Compulsory Licensing, Budapest Treaty, National Biodiversity Authority (NBA), Basic concepts of Technology Transfer (TT). | 8 | CO2 |
| 3 | **Biosafety** | Introduction, Biosafety issues, Biological Safety Cabinets and their types, Biosafety levels (BSL-1, BSL-2, BSL-3, BSL-4), Containment regulations for biohazards, GMOs/LMOs, National and International Biosafety guidelines and regulations, Regulatory Agencies-Institutional Biosafety Committee, GEAC, RCGM. | 8 | CO3 |
| 4 | **Bioethics** | Introduction, necessity and limitation, Different paradigms of Bioethics, Bioethics in Biotechnology, Medical Bioethics and bioethics dilemmas in medical treatment, Legal implications of Bioethics. | 8 | CO4 |

| Reference Books: | |
|---|---|
| 1. | Alexander I. Poltorak; Paul J. Lerner: Essentials of Intellectual Property: Law, Economics, and Strategy, Wiley, 2011 (2nd Edition) |
| 2. | Diane O. Fleming, Debra L. Hunt Biological Safety: Principles and Practices, 4th Edition. ASM 2006 |
| 3. | S. Parashar, D. Goel: IPR, Biosafety and Bioethics, Pearson India 2013 |
| 4. | M. Keru: Ethical Biotechnology, Global Vision Publishing House |

| e-Learning Source: |
|---|
| **https://youtu.be/5fvpsqPWZac?si=p8DVXgUGTGOv8WLI** |
| **https://youtu.be/0YBZci0rCGc?si=qZRkVqlkDQkThZj6** |

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PO-PSO / CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| **CO1** | 2 | 2 | | | 1 | 3 | 1 | | | | 3 | 3 | 2 | 3 |
| **CO2** | 2 | 2 | 1 | | 1 | 2 | 2 | | | | 3 | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 1 | | 3 | 3 | 3 | | | | 3 | 2 | 2 | 1 |
| **CO4** | 2 | 1 | 1 | | | 3 | 3 | | | | 3 | 1 | 1 | 1 |

**Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| | |
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

**Effective from Session: 2020-21**

| Course Code | MT113 | Title of the Course | Mathematics-II in Bioengineering | L | T | P |
|---|---|---|---|---|---|---|
| Year | 1 | Semester | 2 | 3 | 1 | 0 |
| Pre-Requisite | 10+2 | Co-requisite | | | | |
| Course Objectives | | The purpose of this undergraduate course is to impart basic and key knowledge of Infinite series, Differential Eq Graphical Presentation of Data and Bivariaie data. By using the principal of applied mathematics to obtain qua relations which are very important for higher studies. After successfully completion of course, the student w explore subject into their respective dimensions. | | | | |

### Course Outcomes

| | |
|---|---|
| CO1 | Students will be able to find and interpret Infinite series, Convergence, Divergence, Comparison test, Ratio's Test, Cauchy's nth root t Leibnitz's test (without proof), Absolute and conditional convergences, Taylor's and Maclaurin's series for a function of one variable |
| CO2 | Students will be able to Evaluate and Interpret Successive differentiation, Leibnitz's theorem (without proof), Partial derivatives, Maxi minima, Jacobians. Integration-reduction formulae of trigonometric functions. |
| CO3 | Students will be able to Describe Differential equations: linear differential equation of first order, linear differential equation of first ord higher order with constants coefficient. Complementary functions and |
| CO4 | particular integrals, Cauchy's and Euler's equations |
| CO5 | Students will be able to Find and Interpret graphical presentation of data, Bar chart, Pie chart, Histogram, Frequency curve and Ogive curve. Central Tendency and its measures: Mean, Medians, Mode, Harmonic mean And Geometric mean. Dispersion and its measures: Range, Quartile deviation. Mean deviation, Standard deviation and coefficient of variation. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | M |
|---|---|---|---|---|
| 1 | | Infinite series, Convergence, Divergence, Comparison test, Ratio's test, Cauchy's nth root test, Leibnitz's rest ( witbput proof), Absolute and conditional convergences, Taylpr's and Maclaurin's series for a function of one variable. | 08 | |
| 2 | | Successive differentiation, Leibnitz's theorem (without proof), Partial derivatives, Maxima-rninima, Jacobians. Integration - reduction formulae of trigonometric funtions. | 08 | |
| 3 | | Differential Equations: Linear differenti equations of first order, Linear differential equations of higher order with constant coefficients, Complementary functions and particular integrals, Caucby's and Euler's equations | 08 | |
| 4 | | Graphical Presentation of Data: Bar chart. Pie chart, Histogram, Frequency curve and Ogive curve. Central Tendency and its measures: Mean, Median, Mode, Harmonic mean and Geometric mean, Dispersion and its measures: Range. Quartile deviation. Mean deviatinn. Standard deviation and coefficient of variation. | 08 | |
| 5 | | Bivariaie data: Measures of relationship, Scatter diagram. Correlation, Karl Pearson's coefficient of Correlation, Spearmen's Rank Correlation coefficient, Regression analysiss, fitting of linear regression equations and its properties. | 08 | |

### Reference Books:

Text Book of Differential Calculus: Shanti Narayan
Text Book of Integral Calculus: Ram Ballabh
Text Book of Differential Calculus: Ram Ballabh
Text Book of Integral Calculus: Shanti Narayan
S. Probabilit y and Statistics: Gupta JS. Cliand Publication

### e-Learning Source:

https://elearningk12.com

https://www.mdpi.com

https://www.mathisfun.com

### Course Articulation Matrix: (Mapping of COs with POs and PSOs)

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

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

| | |
|---|---|
| Name & Sign of Program Coordinator | Sign & Seal of HoD |

# Integral University, Lucknow

| Effective from Session: 2025-26 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Course Code | ME103 | Title of the Course | ENGINEERING GRAPHICS | L | T | P | C |
| Year | I | Semester | I/II | 0 | 0 | 2 | 1 |
| Pre-Requisite | None | Co-requisite | None | | | | |
| Course Objectives | To impart knowledge to the students regarding fundamentals of engineering graphics and engineering drawings of two dimensional and three dimensional objects and to improve technical communication skill in the form of communicative drawing. | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | Understand the fundamentals of engineering drawing, use of geometrical instruments and drawing steps. |
| CO2 | Understand the concept of projection and acquire visualization skills, draw the projection of points, lines and planes. |
| CO3 | Understand classification of solids and projection of solids at different positions. |
| CO4 | Perceive the exact sectioned view of solids and development of their surfaces. |
| CO5 | Learn to draw isometric projections and perspective views of an object. |

| S. No. | Title of the Experiment | List of Experiment | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | Lettering and geometrical constructions | Introduction to sketching, principal views, orthographic projections, principles of dimensioning, and geometrical constructions | 2 | CO1 |
| 2 | Computer Aided Graphics. | Introduction to Computer Aided Graphics | 2 | CO1 |
| 3 | Projections of points and lines | Drafting of points and lines and their projections | 2 | CO2 |
| 4 | Projections of planes | Drafting of planes and their projections | 2 | CO2 |
| 5 | Projections of solids | Drafting of solids and their projections | 2 | CO3 |
| 6 | Sectioning of solids | Drafting of sections of solids | 2 | CO4 |
| 7 | Development of surfaces | Drafting of development of surfaces | 2 | CO4 |
| 8 | Isometric projections | Drafting of Isometric views | 2 | CO5 |

| Reference Books: |
|---|
| Pradeep Jain, Engineering Graphics and Design, Khanna Books Publisher |
| N D Bhatt, Engineering Drawing, Charotar Publication |
| R K Dhawan, A Textbook of Engineering Drawing, S Chand Publication |

| e-Learning Source: |
|---|
| **https://www.youtube.com/watch?v=yk2SynF31cs** |
| **https://www.youtube.com/watch?v=uojN7SOHPBw&list=PL9RcWoqXmzaJT-fliqTSwUjWU4zCX_H2A** |
| **https://www.youtube.com/watch?v=uFJGNTxJlVk&list=PLDN15nk5uLiBuXu_VXENfC7tfugEI5sAb** |

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PO-PSO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | 3 | | | 1 | 2 | | 2 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 2 | | | | | 1 | 2 | | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | | | | | 1 | 2 | | 2 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 2 | | | | | 1 | 2 | | 2 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 2 | | | | | 1 | 2 | | 2 | 3 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| Effective from Session:2024-25 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Course Code | EE103 | Title of the Course | Basic Electrical Engg | L | T | P | C |
| Year | I | Semester | I / II | 3 | 0 | 2 | 4 |
| Pre-Requisite | None | Co-requisite | None | | | | |
| Course Objectives | • Knowledge and concept of D.C Circuit Analysis and Network Theorems Circuit.<br>• Use of Steady State Analysis of Single-Phase AC Circuits AC fundamentals.<br>• Knowledge and concept of Three Phase AC Circuits Three phase system and measuring devices.<br>• Basic concepts of Power System and Transformer<br>• Study of Electromechanical energy conversion devices: AC/ DC Machines. | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | Know about the concept of D.C Circuit Analysis and Network Theorems Circuit. |
| CO2 | Steady State Analysis of Single-Phase AC Circuits AC fundamentals. |
| CO3 | Know about the concept of Three Phase AC Circuits Three phase system and measuring devices |
| CO4 | Layout of Power System and transformer |
| CO5 | Know about Electromechanical energy conversion devices: AC/ DC Machines |

## THEORY

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | D.C. Circuit Concept and its Analysis | **Circuit concepts:** Active and passive elements, linear and nonlinear network, unilateral and bilateral elements, Series and Parallel connections, Ohms law, Kirchhoff's Law: loop and nodal methods of analysis.<br>**Network theorems:** Superposition theorem, Thevenin's theorem, Maximum Power Transfertheorem | 8 | CO1 |
| 2 | Domestic/ Single Phase A.C. Circuits and its Analysis | **AC fundamentals:** Average and effective value of Sinusoidal waveform , form factor and peak factor, Concept of phasor, Analysis of R, L and C Circuits, power factor, Apparent, active and reactive powers, causes and problems of low power factors, resonance in series RLC circuit. | 8 | CO2 |
| 3 | Commercial/ Industrial Three Phase A.C. Circuits and its measurement | **Three phase system:** Its necessity and advantages, meaning of phase sequence, star and delta connections, balanced supply, line and phase voltage/current relationship.<br>**Measuring Instruments:** Types of instruments: construction and working principle of PMMC, MI type instruments, Electrodynamometer type wattmeter. | 8 | CO3 |
| 4 | Transformer and its concept in Household/ Commercial application | **Magnetic circuit:** Concepts, analogy between electric and magnetic circuit.<br>**Single Phase Transformer**: Principle of operation, construction, emf equation, losses andefficiency. | 8 | CO4 |
| 5 | Household/ Industry oriented Electrical Machines | **DC Machines:** Construction, Types, Principle of operation and application.<br>**Single Phase Induction Motor**: Principle of operation and application.<br>**Three Phase Induction Motor**: Principle of operation and application.<br>**Three Phase Synchronous Machines**: Principle of operation and application. | 8 | CO5 |

## PRACTICAL

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Verification of Thevenin's Theorem. | 2 | 1 |
| 2 | Verification of Superposition Theorem. | 2 | 1 |
| 3 | Verification of Maximum Power Transfer Theorem. | 2 | 1 |
| 4 | To study V-I characteristics of diode. | 2 | 2 |
| 5 | To study the input & output characteristics of BJT in CE configuration. | 2 | 2 |
| 6 | To study the full wave rectifier circuit with & without filter and determine the ripple factor. | 2 | 2 |
| 7 | To study the phenomenon of resonance in series RLC circuit. | 2 | 3 |
| 8 | Determination of losses in single phase transformers by OCT and SCT. | 2 | 3 |
| 9 | To calibrate a single-phase induction type energy meter. | 2 | 4 |
| 10 | To study the running and reversing of a three phase SCIM. | 2 | 4 |

| 11 | Study of OP Amp based inverting and non-inverting amplifier | 2 | 2 |
|----|-----------------------------------------------------------|---|---|

**Reference Books:**

1. V.Deltoro, "Principle of Electrical Engg." PHI, 2009.

2. M.A Mallick, Dr. I. Ashraf, "Fundamental of Electrical Engg," CBS Publishers, 2010.

3. A. Hussain, "Basic Electrical Engg" Dhanpat Rai & sons, 2007

4. I J Nagrath,"Basic Electrical Engg" ,TMH, 2010.

| PO-PSO CO | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 1 | 1 | 3 |   |   |   |   | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 1 | 1 |   |   |   |   | 2 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 1 | 1 | 2 | 2 | 3 |   |   |   | 3 | 2 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 3 | 3 |   |   |   |   | 2 | 3 | 2 | 3 |
| CO5 | 3 | 1 | 1 | 1 | 1 | 2 | 1 |   |   |   | 2 | 3 | 2 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**