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	To realize that apparently different ideas of Optics such as Interference and Diffraction have interrelationship between them.
CO2	To grow in ideas of different aspect of light and develop connection between daily life applications and science
CO3	To realize the importance of instruments and spectroscopy in the characterization of materials.
CO4	To grow in developing the understanding of crystallography and its different parameters.
CO5	To grow in developing connection between daily life utility and material science and to evaluate that how totally different manifestation of Modern Science leads to new technology.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Wave Optics**	***Theory*:** Ramsden and Huygens eyepieces, coherent sources, Fresnel's biprism, thin film interference, Newton's ring, Fraunhoffer's diffraction at single slit, Fraunhoffer's diffraction at N-Slits (grating), Rayleigh's criterion of resolution, resolving power of microscope ***Practicals:*** 1. To determine the wave length of monochromatic light with the help of Fresnel's Biprism. 2. To determine the wave length of monochromatic light by Newton's ring. 3. To determine the wavelength of prominent spectral lines by plane diffraction grating.	8	1
2	**Polarization and Laser**	*Theory*: Types of Polarised light, Double refraction, Nicol prism, Optical activity, polarimeter (Laurent's and Biquartz). Characteristics of laser beam, Main components of laser, optical gain, Einstein's coefficients, He-Ne laser, Nd-YAG laser. ***Practicals:*** 1. To determine the specific rotation of cane sugar solution using Half Shade polarimeter. 2. To determine the refractive index of a liquid using laser.	8	2
3	**Instrumentation and Elementary Molecular Spectroscopy**	***Theory:*** Electron microscope: Principle and its working, Region of electromagnetic spectrum, Diatomic molecule as a rigid rotator and its spectrum, Non-rigid rotator, Vibrational spectra of diatomic molecule (simple harmonic oscillator and anharmonic oscillator, Qualitative discussions only), Raman Scattering (Quantum and classical theory of Raman effect) ***Practicals: NIL***	8	3
4	**Crystal Physics**	***Theory:*** Introduction to crystal structure (Lattice, basis, unit cell, lattice parameters) Seven crystal systems and fourteen Bravais lattices, Coordination number, nearest neighbor distance, atomic radius and atomic packing fraction for SC, BCC and FCC, Simple crystal structures of NaCl and diamond cubic, Miller indices, Origin of X-rays (Continuous and characteristic), Bragg's law, Moseley's law. ***Practicals: NIL***	8	4
5	**Quantum Physics and Nanotechnology**	***Theory:*** Wave function and its physical admissibility, orthogonality of wavefunctions, normalization of wave functions, Schrodinger wave equation, Particle in a 1-D box, Identical particles, symmetric and anti symmetric wave functions. Introduction to nanotechnology and its applications, Nanostructure formation techniques (CVD, sputtering) ***Practicals:*** 1. Plot the graph showing variation of magnetic field with distance along the axis of a circular current carrying coil and then to determine the radius of the coil from it. 2. To determine the energy band gap of a semiconductor using a PN junction diode. 3. To determine the coefficient of viscosity of water by Poiseuille's method. 4. To determine the resistance per unit length of Carey Foster's bridge wire and to find the specific resistance of given wire. 5. To verify Stefan's law by electrical method.	8	5

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

	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					1										2
CO2			1		2							2			2
CO3	1														2
CO4				3								2			2
CO5	2			2	2							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: 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**

Integral University, Lucknow

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. • The key component of the various types of professional communication is communication in English, which is now a global language. • 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. 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 Introduction (SWOT Analysis) 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 Importance of Spoken English Status of Spoken English in India (Theory)	**6**	**CO 2**
		Lab-2 International Phonetic Alphabets (IPA) Symbols 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 **Oral Communication Practice**: - Asking for and giving information Congratulating people on their success Expressing condolences 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 **Oral Practice:** Group Discussion (Based on Topic and Case Study) Debate (Topic Based) (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 Oral Presentation through PPT (Topic based) (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	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO 2	PSO 3	PSO4	PSO5
CO 1	1	1	1	2	1	2	1	3	3	3	3	2	3	2	2	1	-
CO 2	1	1	1	1	1	3	1	3	3	3	3	3	1	1	1	1	-
CO 3	1	1	2	2	1	3	2	3	3	3	2	2	1	1	1	1	-
CO 4	1	1	1	2	1	2	2	3	2	3	2	1	1	1	1	1	-
CO 5	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: 2014							
Course Code	ES 101	**Title of the Course**	Environmental Studies	**L**	**T**	**P**	**C**
Year	1	**Semester**	1	2	1	0	3
Pre-Requisite	10+2	**Co-requisite**	None				
Course Objectives	The purpose of this undergraduate course is to impart basic and key knowledge of environment and ecosystem. This will help students in enhancing their knowledge of biodiversity and its conservation. After successful completion of course, the student will able to explore concept of the subject into their respective dimensions.						

Course Outcomes	
CO1	Gain knowledge about environment and Ecosystem
CO2	Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.
CO3	Gain knowledge about the conservation of biodiversity and its importance.
CO4	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.
CO5	Students will learn about increase in population growth and its impact on environment.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Environment & Ecosystems	Environment, its components and segments, Multidisciplinary nature of Environmental studies, Concept of Sustainability and sustainable development, Environmental movements, Ecosystem, Structure & Function, Energy flow in the Ecosystem, Ecological Pyramids and Ecological Succession.	8	CO1
2	Natural Resources	Renewable and non-renewable, Soil erosion and desertification, Deforestation, Water: Use and over exploitation, Impacts of large Dams, Case studies	8	CO2
3	Biodiversity and Conservation	Levels of biological diversity, Hot spots of biodiversity, India as a Mega Diversity Nation, Endangered & endemic species of India, Threats to Biodiversity, Conservation of Biodiversity, Ecosystem and biodiversity services.	8	CO3
4	Environmental Pollution, Policies and Practices	Environmental pollution, Solid waste management, Ill effects of fireworks, Climate change, Ozone layer depletion, acid rain and impacts on human communities and Environment, Environmental Laws: Environment Protection Act, Wildlife protection Act, Forest conservation Act, Convention on Biological Diversity (CBD), Tribal rights, Human wildlife conflicts.	8	CO4
5	Human Population and the Environment	Human population growth: Impacts on environment, human health and welfare, Resettlement and rehabilitation of project affected persons, Environmental ethics, Environmental communication and public awareness, case studies.	8	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)
5) Cunningham W.P.2001.Cooper, T.H. Gorhani, E & Hepworth, Environmental encyclopedia, Jaicob Publication House, Mumbai.
6) De. A.K. Environmental chemistry Willey Eastern Limited.
7) Glick, H.P.1993 water in crisis, Pacific Institute for studies in dev, Environment & security, Stockholm Env, Institute, Oxford Univ, Press 473 p.
8) Hawkins R .E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay.
9) Heywood, V.H. & Watson, R. T.1995.Global biodiversity Assessment Cambridge Univ. Press 1140 p.
10) Jadhave, H. and Bhosale, V. M. 1995 Environmental protection and laws, Himalaya pub, house, Delhi.284 p.
11) Mckinnery, M.L. and School, R. M.1996 Environmental science systems and solutions, web enhanced edition 639 p.
12) Mhaskar A.K. Matter Hazardous, Techno Science Pub (TM)
13) Miller T.G. Jr, Environmental Ecology, W. B. Saunders Co.USA,574 p. 16
14) Odum, E.P.1997.Fundamental chemistry, Goel Pub House Meerut.
15) Survey of the Environment, The Hindu (M).
16) Sharma B.K.2001.Environmental Chemistry, Goel Pub .House Meerut

e-Learning Source:

https://byjus.com/biology/difference-between-environment-and-eCOsystem.
https://www.youtube.com/watch?v=dRPl4TB8w7k
https://www.youtube.com/watch?v=3fbEVytyJCk
https://www.vedantu.com/biology/conservation-of-biodiversity
https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/difference-between-environment-and-eCOsystem.

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	1	2	2	1	1	1	3	1	1	1	1	2	1	1	1
CO2	1	1	1	1	1	1	3	1	1	1	1	1	2	3	2
CO3	1	1	2	1	1	1	2	1	1	1	1	2	1	1	1
CO4	1	1	1	1	1	1	2	1	1	1	1	2	1	1	1
CO5	1	1	2	1	1	2	3	2	1	2	1	2	1	1	1

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

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	BE115	**Title of the Course**	Introduction to Agriculture	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**2**	**1**	**0**	**0**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	• To provide knowledge of preharvest technology and agronomic practice after green revolution. • To acquaint students with important agricultural crops and different seeds.						

Course Outcomes	
CO1	Understand and evaluate the Indian agriculture system, challenges and opportunities.
CO2	Understand and analyse oilseeds and different soil system.
CO3	Apply knowledge for greater sustainable solutions to the important agriculture crops and farming practices.
CO4	Evaluate individuals in comprehending the early attempts made by the government, farmers, and scientists to achieve food self-sufficiency.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Indian Agriculture: importance present status**	Indian agriculture and economic development, challenges in agriculture, weakness and strength of agriculture sector.	8	CO1
2	**Types of seeds, soil and plant nutrients**	Definition of seeds, certification and quality attributes of seeds, types of seeds (monocot and dicot seeds),Labelling and certification of seeds. Definition of Soil, Arable and Non-arable land, soil classification (alluvial, Black, Red, laterites). Plant nutrients - deficiency, types of nutrition, criteria of essential, mobile and immobile nutrients.	8	CO2
3	**Important Agricultural Crops**	Wheat, Rice, Maize, Groundnut, and soybean, origin, classification, field preparation for cultivation: soil preparation, seed & sowing, methods of sowing.	8	CO3
4	**Green Revolution and organic farming**	Origin of green revolution, growth and importance, merits and demerits of green revolution. Organic farming, integrated organic farming and product certification, classification of organic farming.	8	CO4

Reference Books:

1.ICAR Handbook chapter of weather and agriculture 6th Edition 2024

2.Agricultural and food marketing management, FAO, ISBN 92-851-1003

3. Raising Field Crops, Chidda Singh. 2nd Edition 2012

4.Organic agriculture NPOF manual

e-Learning Source:

https://egyankosh.ac.in/handle/123456789/82137

https://ecourses.icar.gov.in/

	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	2	2	2	1	2	2	1						1	1	
CO2	3	1	3	3	3	3	3						1	1	
CO3	2	2	3	2	2	2	1						2	3	2
CO4	3	3	3	3	3	3	3						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: 2024-25							
Course Code	BE116	**Title of the Course**	Introduction to Food and Nutrition	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**0**	**2**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To provide the students an opportunity to learn basics of food, its types, diet, nutrition, and its regulation						

Course Outcomes	
CO1	Understanding the basics of food & nutrition, its role and applications in food groups
CO2	Analyzing food pyramid, diets, and the role of dietary guidelines in maintaining personal health by devising personalized diet
CO3	Evaluating the role in general nutrition and health management, nutrients, and health status of population
CO4	Analyzing the correlation between growth , development and its inter dependence with nutrition to design specific diet

Theory

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Basic concepts of food and nutrition**	General concept of Food and Nutrition: Nutrients, Phytonutrients; Micronutrients and Macronutrients; Food Nutrients (Carbohydrates, Proteins, Fats, Fiber, Vitamins and Minerals) Food Groups (Five Groups); various cooking methods and its effect on nutrients (blanching, boiling, steaming, roasting, broiling, cooking under pressure)	8	CO1
2	**Diet and Regulations**	Dietary Guidelines: Food pyramid, Balanced diet; Dietary References Intake: Estimated average requirements, Recommended dietary allowances (Reference Man and Reference Woman), Adequate intakes, Tolerable upper intake levels and energy expenditure.	8	CO2
3	**Nutrients and their function**	Principles of Nutrition; Food and Its function (Physiological, Social); Body Mass Index, Malnutrition its types, causes and solutions: Under Nutrition, Over nutrition, Personalized Nutrition and its role in disease prevention and health management	8	CO3
4	**Clinical Nutrition**	Growth & Development from infancy to adulthood: Somatic, physical, brain and mental development, puberty, menarche, pre-pubertal and pubertal changes, Factors affecting Growth and development. Importance of Nutrition for ensuring adequate development. Clinical Signs of various deficiencies diseases: Malnutrition (Protein Energy Malnutrition PEM); Vitamins and Minerals deficiency etc.	8	CO4

Practical

S. No.	List of Experiment	Contact Hrs.	Mapped CO
1	Food group- Grouping of foods, discussion on nutritive value.	4	CO1, CO2
2	Edible portion: Determination of edible portion percentage of different foods.	3	CO1
3	Calculations of BMR and BMI	4	CO2, CO3
4	Nutritional Labeling of Food Products	3	CO2
5	General concepts of weights and anthropometric measurements	5	CO3, CO4
6	Eye estimation of raw and cooked foods	3	CO1
7	Planning and preparation of Diets for Anemia	6	CO2
8	Determination of energy value or calories by using Bomb Calorimeter	4	CO1

Reference Books:

1. Srilakshmi B (2014): Dietetics, 7th Multi colour Ed. New Age International (P) Ltd.
2. Swaminathan M (2007): Essentials of Food and Nutrition(Vol. I & II), 2nd Ed. Bappco
3. Nutrient Requirements and Recommended Dietary Allowance for Indians, Indian Council of Medical Research: New Delhi.
4. Mann J and Truswell S (2017) : Essentials of Human Nutrition, 5th Ed. Oxford University Press.

e-Learning Source:

https://ugcmoocs.inflibnet.ac.in/assets/uploads/1/132/4536/et/1%20Script200302090903033030.pdf

https://main.icmr.nic.in/sites/default/files/upload_documents/DGI_07th_May_2024_fin.pdf

https://cctbnd.wordpress.com/wp-content/uploads/2015/08/clinical-nutrition-lecture-note-1.pdf

	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	1	1	2	1	3	1	2	1	2			2	2	1	3
CO2	3	2	1	1	2	2	1	3	1			1	1	1	3
CO3	3	2	1	2	2	1	1	1	2	2	1	3	2	2	2
CO4	3	1	1	2	2	3	2	3	2	2	1	3	2	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: 2024-25							
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 thermodynamics process 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 To perform facing, plain turning, step turning, taper turning & chamfering operations	4	CO6
2	**Fitting shop**	To perform step cutting, filing, drilling & tapping To make a 90° v-groove fitting on mild steel flat	4	CO6
3	**Carpentry shop**	To make a mortise and tenon joint To make a corner lap joint	4	CO6
4	**Smithy shop**	To make a square punch from mild steel round rod 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) 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

https://www.youtube.com/watch?v=DzyIEz3dKXQ&t=1s

https://www.youtube.com/watch?v=A-3W1EbQ13k&list=PLyqSpQzTE6M_MEUdn1izTMB2yZgP1NLfs

https://www.vlab.co.in/

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	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

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 • Indian Diaspora • Ancient Indian Civilization. • National and International Awards & Awardees	05	01
2	Literature, Science, Astrology	• Indian Epics: Ramayan & Mahabharata • Prominent litterateur: Shudrak, Kalidas, Amir Khusru, • Kautilya's Arthashastra • Panini's Ashtadhyayi	05	02
3	Indian Heritage	• Cultural Heritage in India: Buddhist Monuments at Sanchi, Ajanta & Ellora Caves, Khajuraho, Taj Mahal • 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 • Jainism: Mahavir's Biography and Education • 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 • Raja Ram Mohan Roy& Brahmo Samaj • Swami Vivekanand and his philosophies • Mahatma Gandhi: Role of Gandhi in Indian National Movement • 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: 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	• Adoptive curiosity and cultivate interest in chemistry. • Attain a comprehensive knowledge and understanding of Chemistry. • Improve an understanding for chemistry and its practical applications in everyday life. • Develop proficiency in solving qualitative and quantitative problems. • Enhance practical and technical skills. • Develop the ability to work effectively and safely in a laboratory environment. • Improve communication skills to effectively convey scientific concepts and findings.		

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. Graphite and fullerenes: Preparation, properties and applications. ***Practicals:*** 1. To determine the strength of the given HCl solution by titrating it against NaOH solution using a pH meter. 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. ***Practicals:*** 1. Identification of functional group in the given organic compound 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. ***Practicals:*** 1. To determine the iron concentration in the given water sample by Spectrophotometer using potassium thiocyanate as colour developing agent. 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. ***Practicals:*** 1. Synthesis of phenol formaldehyde resin 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. 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. ***Practicals:*** 1. To determine the temporary and permanent hardness in the given water sample by Complexometric titration using EDTA as the standard solution. 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%

	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	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: 2024-25							
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

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	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. • To provide fundamental concepts of programming language 'C'. • To show the use of functions and pointers to different problems. • To study the implementation of arrays, matrices and strings. • 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, Firewalls, Anti-Virus, Translators. 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 * * * * * * * * * *	2	3
16	Write a Program to Print Pattern1 2 3 4 1 2 3 1 2 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. >=35 and <45 III Div >=45 and <60 II Div >=60 I Div 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.

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	PSO4
CO1	**2**	**2**	**2**	**1**								**2**	**3**	**1**	**1**	
CO2	**3**	**3**	**1**	**1**									**3**	**3**	**2**	
CO3	**3**	**3**	**3**	**2**									**3**	**3**	**2**	
CO4	**3**	**3**	**2**	**2**	**1**								**3**	**3**	**2**	
CO5	**3**	**3**	**2**	**2**	**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 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	Evaluate the equilibrium calculations of microbial growth and product and to solve the energy conversion performance in a microbiological system.

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	**Thermodynamics of microbial growth kinetics**	Thermodynamics in the context of Biotechnological Processes and Systems, Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Including Heat using the Herbert–Pirt Relation for Electron Donor, thermodynamics and stoichiometry of Product Formation.	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	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	1	2	1					3	3	3	3
CO2	3	2	1	1	1	1	1					2	3	2	3
CO3	3	3	2	2	1	1	1					3	3	3	3
CO4	3	3	1	1	1	1	1					2	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	BE117	**Title of the Course**	Introduction to Biosciences	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**2**	**1**	**0**	**0**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To acquaint students with basic biological concepts fostering scientific thinking and foundational knowledge for advanced studies.						

Course Outcomes	
CO1	Explore systematics, taxonomy, and classification of plant and animal kingdoms.
CO2	Examine and elucidate various physiological processes in plants.
CO3	Understand and analyze the fundamentals of cell biology.
CO4	Analyze and evaluate the structures and functions of key biological molecules and synthesize this knowledge to understand their roles in food technology

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Diversity in living world**	Systematics – objectives of systematics, classification, taxonomy - taxonomic hierarchy and binomial nomenclature. Biological classification Plant kingdom viz. Monera, Protista, fungi, plantae and Animalia. Kingdom Plantae – Introduction and classification. Gymnosperms – Definition and classification. Angiosperms – Morphology and Reproduction of flowering plants.	8	CO1
2	**Plant Physiology**	Plant growth – Seed germination, characteristics of growth, phases of growth. Photosynthesis – Definition and structure and function of chloroplast. Respiration – Definition and its mechanism. Reproduction in plants – mode of reproduction.	8	CO2
3	**Cell: Structure and Function**	Cell as a basic unit of life. Introduction, Cell Theory, Types (Eukaryotic and Prokaryotic cell; Plan, Animal and Bacterial cell), Structure and function of the cell and cell organelles, Cell division, Central dogma.	8	CO3
4	**Biomolecules**	Structure and function of Macromolecules: Carbohydrates, Proteins, Lipids, Nucleic acid. Introduction, classification and nomenclature of enzymes.	8	CO4

Reference Books:

1. Dutta A. C. and Dutta T. C. (2014) Botany (For Degree Student) Oxford University Press, New Delhi.
2. Pandey S.N. and Sinha B. K. (1982). Plant Physiology. Vikas Publishing House Pvt. Ltd.
3. Essential Cell Biology by Alberts.6th Edition (2023) (WW Norton & Co; Sixth International Student Edition)
4. Verma V. (2013) Botany. Ane's Student Edition, New Delhi, Ane Books Pvt. Ltd.
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	PO12	PSO1	PSO2	PSO3
CO1							2					3	3		
CO2							1					3	3		
CO3							1					3	3		
CO4							1					3	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: 2020-21							
Course Code	**MT113**	**Title of the Course**	Mathematics-II in Bioengineering	**L**	**T**	**P**	**C**
Year	1	**Semester**	2	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 Infinite series, Differential Equations, Graphical Presentation of Data and Bivariaie data. By using the principal 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 find and interpret Infinite series, Convergence, Divergence, Comparison test, Ratio's Test, Cauchy's nth root test, 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, Maxima-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 order with 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.**	**Mapped CO**
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	CO1
2		Successive differentiation, Leibnitz's theorem (without proof), Partial derivatives, Maxima-rninima, Jacobians. Integration - reduction formulae of trigonometric funtions.	08	CO2
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	CO3
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	CO4
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	CO5

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**	**PSO3**
CO1	3	1	1	1	2	3	2	1	2	1	2	1	2	3	2
CO2	3	2	1	1	2	1	2	2	2	2	1	2	1	1	1
CO3	2	2	1	1	2	1	1	2	2	2	2	1	3	2	2
CO4	3	2	2	1	1	1	1	1	1	2	1	1	1	3	3
CO5	3	2	1	1	2	1	2	1	2	1	2	1	2	2	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: 2022-2023							
Course Code	**EE103**	**Title of the Course**	**Basic Electrical Engg.**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	Knowledge and concept of D.C Circuit Analysis and Network Theorems Circuit.Use of Steady State Analysis of Single-Phase AC Circuits AC fundamentals. Knowledge and concept of Three Phase AC Circuits Three phase system and measuring devices. Basic concepts of Power System and Transformer. 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 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

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**D.C Circuit Analysis and Network Theorems**	Circuit concepts: Concept of network, Active and passive elements, linear network and non linear network, unilateral and bilateral elements, lumped and distributed network, sources, open circuit and short circuit, source transformation, Kirchhoff's Law. Loop analysis and nodal analysis, star delta transformation. Network theorems: Needs of theorem, Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem.	8	CO1
2	**Steady State Analysis of Single Phase AC Circuits**	AC fundamentals: Average and effective value of Sinusoidal waveform , form factor and peak factor,concept of phasors, phasors representation of sinusoidally varying voltage and current, analysis of series RLC circuits. Apparent, active and reactive powers, power factor, causes and problems of low power factor, power factor improvement, resonance, bandwidth and quality factor in series circuit.	8	CO2
3	**Three Phase AC Circuits**	Three phase system: Its necessity and advantages, meaning of phase sequence, star and delta connections, balanced supply, line and phase voltage/current relationship. Measuring Instruments: Types of instruments: construction and working principle of PMMC, MI type instruments, induction type energy meter.	8	CO3
4	**Introduction of Power System**	General layout of electrical power system, standard generation, transmission and distribution voltage levels, concept of grid.Magnetic circuit: Concepts, analogy between electric and magnetic circuit. Single Phase Transformer: Principle of operation, construction, emf equation, equivalent circuit, losses, efficiency, Introduction to auto transformer.	8	CO4
5	**Electromechanical energy conversion devices**	DC Machines: Types, emf equation of generator and torque equation of motor, applications. Three Phase Induction Motor: Types, principle of operation, applications. Single Phase Induction Motor: Principle of operation and introduction to methods of starting, applications. Three Phase Synchronous Machines: Principle of operation of alternator, synchronous motor, applications.	8	CO5

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.

e-Learning Source:

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	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3						3	3	3	2	3		
CO2	3	3	3	2	1	1						2	3	2	2	3		
CO3	3	2	1	1	2	2	3					3	2	2	2	3		
CO4	3	2	2	2	3	3						2	3	2	2	3		
CO5	3	1	1	1	1	2	1					2	3	2	2	3		

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

	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session:							
Course Code	EC101	**Title of the Course**	Basic Electronics	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To understand the concepts of mechanism of conduction in semiconductors: Mobility and Conductivity, Electrons and holes in intrinsic To learn the semiconductors, Donor and acceptor impurities, Fermi Level. To learn the working and it's characteristic of PN junction diode, Zener and Avalanche Breakdown mechanism. To learn the working half wave rectifier, full wave rectifiers and LED.To understand NPN Transistor, Common Emitter, Common Base and Common Collector configuration and their characteristics, transistor biasing circuits. To understand JFET: Construction, principle of working and its characteristics. To learn MOSFET: Working of Enhancement and depletion type N-channel MOSFET, P-channel MOSFET and their characteristics. To understand Switching theory & Logic gates. To learn Number system, Conversion, 2's and 10's Compliments, Addition and Subtraction, Boolean algebra, Logic gates, Minimization of logical function using Karnaugh map. To understand Operational Amplifier. To learn Ideal characteristics of Op-Amp &it's application, Op-Amp as an Inverting, Non-inverting, integrator and differentiator. Block diagram and working of Digital Multimeter, Function Generator and CRO.						

Course Outcomes	
CO1	Understand the concepts of concepts of mechanism of conduction in semiconductors. Students shall be able to draw I-V characteristic of different diodes also know the working and the applications of different diodes
CO2	Understand the concepts of NPN Transistor, Common Emitter, Common Base and Common Collector configuration and their characteristics. Students can do circuit analysis with different methods of transistor biasing.
CO3	Understand the concepts of JFET: Construction, principle of working and its characteristics. Students shall be able to differentiate between JFEF & MOSFET, working of Enhancement and depletion type N-channel MOSFET, P-channel MOSFET and their characteristics.
CO4	For a given problem, **apply** the concept of Switching theory & Logic gates students shall be able to solve mathematical problems using 2's and 10's compliments, minimize Boolean function using different laws and K map. Students shall be able to design combinational circuits for the given Boolean function.
CO5	Understand the concept of Operational Amplifier and develop Op-Amp as an Inverting, Non-inverting, integrator and differentiator. Students are able to use digital multimeter and draw different lissajous pattern on CRO using function generator.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Mechanism of Conduction in Semiconductors**	Mobility and Conductivity, Electrons and holes in intrinsic semiconductors, Donor and acceptor impurities, Fermi Level.PN junction diode working and its characteristic, Zener and Avalanche Breakdown mechanism. Half wave and full wave rectifiers, LED	8	CO1
2	**BJT characteristics and circuits**	Working of NPN Transistor, Common Emitter, Common Base and Common Collector configuration and their characteristics, transistor biasing circuits	8	CO2
3	**Field Effect Transistors**	**Fie**JFET: Construction, principle of working and its characteristics. MOSFET: Working of Enhancement and depletion type N-channel MOSFET, P-channel MOSFET and their characteristics.	8	CO3
4	**Switching theory & Logic gates**	Number system, Conversion, 2's and 10's Compliments, Addition and Subtraction, Boolean algebra, Logic gates, Minimization of logical function using Karnaugh map.	8	CO4
5	**Operational Amplifier**	Ideal characteristics of Op-Amp &it's application, Op-Amp as an Inverting, Non-inverting, integrator and differentiator. Block diagram and working of Digital Multimeter, Function Generator and CRO.	8	CO5

Reference Books:

Bolyested&Nashekey: Electronic Devices and Circuit Theory, PHI, Milliman&Halkias: Integrated Electronics, McGraw- Hill.

e-Learning Source:

https://www.youtube.com/watch?v=4_nGFY7zgDM, https://www.youtube.com/results?search_query=diode+characteristics

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

PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO 1	**3**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**1**	**3**	**2**	**0**	**0**	**3**	**1**
CO 2	**3**	**2**	**3**						**3**			**1**	**3**				**3**	**2**
CO 3	**3**	**3**	**3**	**1**	**1**				**3**				**3**	**2**	**0**	**0**	**3**	**3**
CO 4	**3**	**3**	**2**						**3**			**1**	**3**				**3**	**3**
CO 5	**3**	**2**	**2**	**1**	**1**				**3**			**1**	**3**	**2**	**0**	**0**	**3**	**2**

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

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