APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

(A State Government University)

B. Tech- 2024

FIRST YEAR SYLLABUS
(GROUP D)

SEMESTER 1
GROUP D

SEMESTER S1

MATHEMATICS FOR LIFE SCIENCE -1

Course Code	**GDMAT101**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Basic knowledge in matrix operations and algebra.	**Course Type**	Theory

Course Objectives:

1. To equip students with a strong mathematical foundation in matrix theory, differentiation, and integration, essential for understanding and optimizing various engineering-related problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Systems of linear equations. Gauss Elimination, Rank of a matrix - Row echelon form, Solutions of Linear systems: Existence, Uniqueness- Fundamental theorem for linear systems - homogeneous and non-homogeneous (theorem without proof), The matrix Eigen value problem. Determining Eigen values and Eigen vectors. **(Text 1: Relevant topics from sections 7.3, 7.4, 7.5, 8.1)**	**9**
2	Introduction to calculus - differentiation from first principles, Differentiation of common functions, Differentiation of a product, Differentiation of a quotient, Function of function (Chain Rule), Introduction to Parametric equations, Differentiation in parameters, Introduction to partial derivatives, first order partial derivatives, second order partial derivatives, Total differential, Rates of change. **(Text 2: Relevant portions from sections 25.1 to 25.7, 27.1, 27.3, 32.1, 32.2, 32.3, 33.1 , 33.2)**	**9**

3	The process of integration, The general solution of integrals of the form ax^n, Standard integrals – polynomials, Trigonometric functions; Definite integrals, Double integrals. **(Text 2: Relevant topics from sections 35.1,35.2,35.3,35.4, 44.1)**	**9**
4	Family of curves, Differential equations, solution of equations of the form $\frac{dy}{dx} = f(x)$, The solutions of equations of the form $\frac{dy}{dx} = f(y)$, The solution of equations of the form $\frac{dy}{dx} = f(x)f(y)$. Procedure to solve differential equations of the form $\frac{dy}{dx} + Py = Q$, Problems on linear differential equation. **(Text 2: Relevant topics from sections 46.1, 46.2, 46.3, 46.4, 46.5, 48.1, 48.2, 48.3)**	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Solve homogeneous and non-homogeneous equations and to find eigen values and eigen vectors of matrices.	**K3**
CO2	Apply the techniques of finding derivatives and partial derivatives of functions in concepts related to rate of change.	**K3**
CO3	Familiarize basic concepts of integration and to find integrals and double integrals of functions.	**K3**
CO4	Solve first order differential equations using various methods.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	2
CO3	3	3	-	2	-	-	-	-	-	-	-	2
CO4	3	3	-	2	-	-	-	-	-	-	-	2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016
2	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis Group	9th edition, 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson	15th edition, 2023
2	Essential Calculus	J. Stewart	Cengage	2nd edition, 2017
3	Elementary Linear Algebra	Howard Anton, Chris Rorres	Wiley	11th edition, 2019
4	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/111/107/111107164/
2	https://archive.nptel.ac.in/courses/111/104/111104125/
3	https://archive.nptel.ac.in/courses/111/104/111104125/
4	https://archive.nptel.ac.in/courses/111/106/111106100/

SEMESTER S1/S2

PHYSICS FOR PHYSICAL SCIENCE AND LIFE SCIENCE
(Common to Groups C & D)

Course Code	**GZPHT121**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory + Lab

Course Objectives:

1. To provide students with a solid background in the fundamentals of Physics and impart this knowledge in Physical Science and Life Science disciplines.
2. To develop scientific attitudes and enable students to correlate Physics concepts with their core programs.
3. To equip students with practical knowledge that complements their theoretical studies and develop their ability to create practical applications and solutions in engineering based on their understanding of Physics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Laser & Fiber Optics** Optical processes – Absorption-Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing – Population inversion- Pumping- Metastable states, Basic components of laser - Active medium - Optical resonant cavity, Construction and working of Ruby laser and CO2 laser, Construction and working Semiconductor laser (qualitative), Properties of laser, Applications of laser. Optic fiber-Principle of propagation of light, Types of fibers-Step index and Graded index fibers - Multimode and single mode fibers,	9

	Acceptance angle, Numerical aperture –Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	
2	**Interference and Diffraction** Introduction, Principle of super position, Constructive and destructive interference, Optical path, Phase difference and path difference, Cosine law- reflected system- Condition for constructive and destructive interference, Colours in thin films, Newton's Rings-Determination of refractive index of transparent liquids and wavelength, Air wedge- Measurement of thickness of thin sheets. Diffraction-types of diffraction, Diffraction due to a single slit, Diffraction grating – Construction - grating equation, Dispersive and Resolving Power (qualitative).	**9**
3	**Quantum Mechanics** Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle- Absence of electron inside nucleus - Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (qualitative)	**9**
4	**Waves & Acoustics** Waves- transverse and longitudinal waves, Concept of frequency, wavelength and time period (no derivation), Transverse vibrations in a stretched string- derivation of velocity and frequency - laws of transverse vibration. Acoustics- Reverberation and echo, Reverberation time and its significance - Sabine's Formula, Factors affecting acoustics of a building. Ultrasonics- Piezoelectric oscillator, Ultrasonic diffractometer, SONAR, NDT-Pulse echo method, medical application-Ultrasound scanning (qualitative)	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Internal Examination- 3 (Lab Examination)	Total
5	10	10	10	5	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the basic principles and properties of laser and optic fibers.	**K2**
CO2	Describe the phenomena of interference and diffraction of light.	**K2**
CO3	Describe the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics.	**K2**
CO4	Apply the knowledge of waves and acoustics in non-destructive testing and in acoustic design of buildings.	**K3**
CO5	Apply basic knowledge of principles and theories in physics to conduct experiments.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											3
CO2	3											3
CO3	3											3
CO4	3	3										3
CO5	3	3			3				2			3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A Textbook of Engineering Physics	M N Avadhanulu, P G Kshirsagar & TVS Arun Murthy	S Chand & Co.	2nd Edition, 2019
2	Engineering Physics	H K Malik , A.K. Singh,	McGraw Hill Education	2nd Edition, 2017
3	Optics	Ajoy Ghatak	Mc Graw Hill Education	6th Edition, 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Physics	G Vijayakumari	Vikas Publications	8th Edition, 2014
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Edition 2003
3	Engineering Physics	Aruldhas G.	PHI Pvt. Ltd	2nd Edition, 2015
4	Fiber Optic Communications	Gerd Keiser	Springer	2021
5	A Text Book of Engineering physics	I. Dominic, A. Nahari	OWL Publications	2nd Edition, 2016
6	Advanced Engineering Physics	Premlet B	Phasor Books	
7	Engineering Physics	Rakesh Dogra	Katson Books	1st Edition, 2019

Video Links (NPTEL, SWAYAM…)	
Module No	**Link ID**
1	https://nptel.ac.in/courses/115102124 https://nptel.ac.in/courses/104104085
2	https://nptel.ac.in/courses/115105537
3	https://nptel.ac.in/courses/115102023 https://nptel.ac.in/courses/115101107
4	https://nptel.ac.in/courses/112104212 https://nptel.ac.in/courses/124105004

1. Continuous Assessment (10 Marks)

i. Preparation and Pre-Lab Work (2 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

ii. Conduct of Experiments (2 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

iii. Lab Reports and Record Keeping (3 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

iv. Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

2. Evaluation Pattern for Lab Examination (5 Marks)

1. Procedure/Preliminary Work/Conduct of Experiments (2 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Setup and Execution: Proper setup and accurate execution of the experiment or programming task

2. Result (2 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.

3. **Viva Voce (1 Marks)**

- Proficiency in answering questions related to theoretical and practical aspects of the subject.

Experiment List

Experiment No.	Experiment (Minimum 10 Experiments)
1	Optical fiber characteristics- Measurement of Numerical aperture.
2	Determination of wavelength of Laser using diffraction grating.
3	Measure the wavelength of Laser using a millimeter scale as a grating.
4	Determination of wavelength of a monochromatic light using Newton's Rings method.
5	Determination of diameter of wire or thickness of thin sheet using Air wedge method.
6	Determination of slit width (diffraction due to a single slit).
7	Measure wavelength of light source using diffraction grating.
8	Determination of resolving power and dispersive power of grating.
9	Characteristics of LED.
10	CRO basics-Measurement of frequency and amplitude of wave forms.
11	Solar Cell- I V and Intensity Characteristics.
12	Melde's experiment- Frequency calculation in Transverse and Longitudinal Mode.
13	LCR circuit –forced and damped harmonic oscillations.
14	Determination of wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.
15	Determination of particle size of lycopodium powder.

SEMESTER S1/S2

CHEMISTRY FOR LIFE SCIENCE

(Common to D Group)

Course Code	**GDCYT122**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory + Lab

Course Objectives:

1. To equip students with a thorough understanding of chemistry concepts relevant to engineering applications.
2. Familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. To raise awareness among students about environmental issues such as climate change, pollution, and waste management, which impact quality of life.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Stereochemistry & Materials for Biological Applications** **Stereochemistry:** Stereo isomerism-Configurational Isomerism- Geometrical & Optical isomers-Wedge & Fischer projections - E-Z Nomenclature- R&S Configuration **Nanomaterials:** Classification based on materials- Synthesis – Sol gel & Chemical reduction – Bio-applications of nanomaterials – Carbon Nanotubes, Fullerenes & Graphene – structure, properties & application. **Polymers:** Biodegradable polymers- PHBV & PLA- Synthesis, properties and applications. Conducting Polymers-Classification-Polyaniline & Polypyrrole-Synthesis, properties and applications (Biosensors & artificial muscles).	9

	Nanopolymers-Dendrimers – biological application.	
2	**Electrochemistry and Corrosion Science** Electrochemical Cell: Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE & Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode & pH Measurement-Conductivity-Measurement using Digital conductivity meter. Li-ion battery & H_2-O_2 fuel cell (acid electrolyte only) construction and working. Corrosion control methods: Galvanic series - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection – Electroplating of copper - Electroless plating of copper.	**9**
3	**Instrumental Methods of Analysis** **Spectroscopy:** Types of spectra - Molecular energy levels - Beer Lambert's law – Numerical problems - Electronic Spectroscopy – Principle, Types of electronic transitions – Role of conjugation in absorption maxima-Instrumentation-Applications – Vibrational spectroscopy – Principle-Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications **Chromatographic methods:** Basic principles and applications of column and TLC-Retention factor. HPLC-Principle, instrumentation (block diagram) - retention time and applications. **Electron Microscopic Techniques:** SEM - Principle, instrumentation and Applications. **Fuels**: Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels. Biofuels- Biodiesel-Green Hydrogen.	**9**
4	**Environmental Chemistry** **Water characteristics**: - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Degree of hardness (Numericals) Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. – Water disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation. Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief	**9**

	procedure) and significance (Numericals). **Waste Management**: Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Chemistry of climate change- Greenhouse Gases-Ozone depletion - Sustainable Development- An introduction to Sustainable Development Goals.	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Internal Examination- 3 (Lab Examination)	Total
5	10	10	10	5	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the use of various materials and their stereochemical influence in Biological applications	**K2**
CO2	Explain the Basic Concepts of Electrochemistry and Corrosion to Explore the Possible Applications in Various Engineering Fields	**K2**
CO3	Apply appropriate analytical techniques for different engineering materials	**K3**
CO4	Outline various water treatment and waste management methods	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	3										2
CO3	3	3										2
CO4	3	3				2	3					2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition-2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition-2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17th Edition - 2015

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4th edn., 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials: Synthesis, Properties and Applications	Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham	Wiley-VCH Verlag GmbH & Co. KGaA	2014
6	Organic Electronics Materials and Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications of Thermal Analysis	Gabbot, P	Oxford: Blackwell Publishing	2008

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/104/106/104106137/ https://archive.nptel.ac.in/courses/113/105/113105102/ https://archive.nptel.ac.in/courses/113/104/113104082/ https://www.youtube.com/watch?v=BeSxFLvk1h0
2	https://archive.nptel.ac.in/courses/113/104/113104102/ https://archive.nptel.ac.in/courses/104/105/104105124/ https://archive.nptel.ac.in/courses/105/104/105104157/

Continuous Assessment (10 Marks)

Continuous assessment evaluations are conducted based on laboratory associated with the theory.

Mark distribution

1. **Preparation and Pre-Lab Work (2 Marks)**

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (2 Marks)**

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (3 Marks)**

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

2. **Viva Voce (3 Marks)**

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for Lab Examination (5 Marks)

1. **Procedure/Preliminary Work/Conduct of Experiments (2 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

2. **Result (2 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.

3. **Viva Voce (1 Marks)**

- Proficiency in answering questions related to theoretical and practical aspects of the subject.

List of Experiments

***Minimum 10 Experiments**

Expt. Nos.	Experiment
1	Estimation of iron in iron ore
2	Estimation of copper in brass
3	Determination of cell constant and conductance of solutions
4	Calibration of pH meter and determination of pH of a solution
5	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin

6	Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
7	Determination of molar absorptivity of a compound (KMnO4 or any water-soluble food colorant)
8	Analysis of IR spectra
9	Identification of drugs using TLC
10	Estimation of total hardness of water-EDTA method
11	Estimation of dissolved oxygen by Winkler's method
12	Determination of calorific value using Bomb calorimeter
13	Determination of saponification value of a given vegetable oil
14	Determination of acid value of a given vegetable oil
15	Verification of Nernst equation for electrochemical cell.

SEMESTER S1

ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING

(Common to Groups A, B & D)

Course Code	**GMEST103**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	2-0-2-0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory & Lab

Course Objectives:

1. To learn the principles and techniques of dimensioning and preparing engineering drawings.
2. To develop the ability to accurately interpret and understand engineering drawings.
3. To learn the features of CAD software

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. (No questions for the end semester examination) Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of a line. Inclination of lines with reference planes. True length and true inclinations of line inclined to both the reference planes.	9
2	Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder only. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	9

3	Sections of Solids: Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems) Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes. (Exclude problems with through holes)	**9**
4	Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere and their combinations. Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (CAD, only internal evaluation)	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment+ Lab Exam	Internal Examination-1	Internal Examination- 2	Total
5	**10+5**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

2 Questions from one module.	**Total**
Total 8 Questions, each question carries 15 marks **(15x4 =60marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		**Bloom's Knowledge Level (KL)**
CO1	Understand the projection of points and lines located in different quadrants	**K2**
CO2	Prepare multiview orthographic projections of objects by visualizing them in different positions	**K3**
CO3	Plot sectional views and develop surfaces of a given object	**K3**
CO4	Prepare pictorial drawings using the principles of isometric projection	**K3**
CO5	Sketch simple drawing using CAD tools.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2										
CO5	3	2	2		3							

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Graphics	Varghese, P. I.	V I P Publishers	2018 edn
2	Engineering Graphics	Benjamin, J.	Pentex Publishers	2016 edn
3	Engineering Graphics	John, K. C.	Prentice Hall India Publishers	2017 edn
4	Engineering Drawing	Bhatt, N., D.	Charotar Publishing House Pvt Ltd.	60th edn 2019
5	Engineering Graphics	Anilkumar, K. N.	Adhyuth Narayan Publishers	2022 edn

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Graphics with AutoCAD	Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K.	Prentice Hall India Publishers	2020 edn
2	Engineering Drawing & Graphics	Venugopal, K.	New Age International Publishers	5th edn 2011
3	Engineering Drawing	Parthasarathy, N. S., and Murali, V.	Oxford University Press	2015 edn

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/112/102/112102304/
2	https://archive.nptel.ac.in/courses/112/102/112102304/
3	https://archive.nptel.ac.in/courses/112/102/112102304/
4	https://archive.nptel.ac.in/courses/112/102/112102304/

SEMESTER S1

BASIC CONCEPTS OF BIOTECHNOLOGY AND BIOCHEMICAL ENGINEERING

(Common to Biotechnology)

Course Code	**GDBBT104**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-1-0-0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory + Lab

Course Objectives:

1. Prepare students to understand the concepts of growth patterns, enzyme catalysis, and biotransformation.
2. Develop a systematic approach in students toward solving problems involved in fermentation based on the end product formation.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Exploring Biological concepts – Different types of Cells -Animal cells, Plant cells, and bacterial cells. Structure of cells, Cycles of life- Mitosis & Meiosis. Structure and function of Biomolecules - carbohydrates (mono-, di-, and polysaccharides), lipids, proteins (amino acids, peptides), and nucleic acids (DNA & RNA). Cell growth and Product synthesis - Nutritional requirements, Growth patterns and kinetics in Batch culture, Conditions/ Factors affecting the cell growth and product synthesis.	**11**

2	Enzymes and Bioenergetics Enzymes: Classification, Catalysis, Steady-state kinetics, Enzyme Inhibition, Regulatory Enzymes, Co-Enzymes, Vitamins Application of Enzymes- Applications of enzymes in industrial, pharmaceutical, and analytical sectors, Enzyme immobilization.	**11**
3	Bioprocess- Basic concepts of Different Upstream and Downstream processes; Intracellular and extracellular products- Growth-associated and non-growth- associated products. Modes of bioreactor operation - batch bioreactor, Disadvantages of batch bioreactor, Continuous bioreactor, advantages of continuous bioreactor, Fed- batch bioreactor, Applications.	**11**
4	Bioreactors - Basic functions of a bioreactor, parts of a fermenter, and their functions. role of aeration and mixing in oxygen transfer, mechanism of mixing, impellers- types, and Flow patterns. Introduction to process instrumentation and control: Common methodologies of measurements, Measuring Instruments: Thermocouples, Venturi meters, U-tube manometer. Biosensors- Enzyme and Microbial Biosensors	**11**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the basic concepts of cell and cell growth patterns	**K1**
CO2	Illustrate biocatalysis and various applications of enzymes	**K3**
CO3	Understand the basic concepts of bioprocess engineering	**K2**
CO4	Analyse common bioreactor parameters and biosensors	**K4**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Bioprocess Engineering-Basic Concepts	M. L. Shuler and F. Kargi	Prentice Hall	2nd Edition, 2015
2	Principles of biochemistry	Nelsen, David L., and Michael M. Cox. Lehninger.	WH Freeman	Macmillan Learning, 2021
3	Biochemical Engineering Fundamentals,	J. E. Bailey and D.F. Ollis	McGraw-Hill Chemical Engineering Series	2nd Edition, McGraw Hill, 2017
4	Bioprocess Engineering Principles	Pauline M Doran	Academic Press, 1995	1995

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Principles of Biomedical Instrumentation	Webb, Andrew G	Cambridge University Press	2018
2	Principles of Fermentation Technology	P. F. Stanbury, S. J. Hall, and A. Whitaker	Elsevier	3rd Edition, 2016
3	Biology for Engineers	Johnson, Arthur T	CRC Press	2018
4	Enzymes: biochemistry, biotechnology, clinical chemistry.	Palmer, T., & Bonner, P. L.	Elsevier	2007

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/102/108/102108086/
2	https://archive.nptel.ac.in/courses/102/102/102102033/
3	https://archive.nptel.ac.in/courses/102/106/102106086/
4	https://onlinecourses.nptel.ac.in/noc20_bt21/preview

SEMESTER S1

INTRODUCTION TO FOOD TECHNOLOGY

Course Code	**GDFTT104**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-1-0-0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To study the different types of food groups and categories of food.
2. To acquire knowledge on basic engineering properties of food
3. To understand mechanics of fluids and basic process calculations

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Food & Nutrients: Introduction to food and nutrients, Definition of food, functions of food, food groups, Nutrients in food– Carbohydrates, proteins, lipids, vitamins and minerals, their classification, functions and sources. Role of water as a nutrient and its dietary sources.	**11**
2	Engineering Properties of Foods: Shape and size – criteria for describing shape and size Volume and methods of measurement of volume, Density, Types, Method of measurement of apparent density, material density, particle density, bulk density, true density- Laws of friction, effect of load and properties of contacting bodies. Effect of sliding velocity and contact surface temperature, effect of water film and surface roughness. Rolling resistance, angle of repose, angle of internal friction, Viscosity and its measurement, firmness and hardness, mechanics of	**11**

	hardness, dynamic hardness, the effect of age, water content, and temperature on the texture of foods.	
3	Fluid Mechanics : definition of fluid- properties of fluids – density, specific gravity, compressibility, surface tension and viscosity – absolute and kinematic viscosity variation of properties with temperature and pressure – rheology of fluids- Newtonian and non-Newtonian fluids –fluid static Pascal's law – hydrostatic equilibrium in gravity and centrifugal field – barometric equation principle of manometer- principle of continuous gravity and centrifugal decanter –Introduction to fluid kinematics - Reynolds experiment – classification of flow. Equation of Continuity (Derivation not needed), Derivation of Bernoulli's Equation and its applications	**11**
4	Basics of Process Calculations- –units and dimensions-basic and derived quantities-conversion of units – conversion of empirical equations – moisture content- wet basis & dry basis, mole concept – method of expressing composition –mole fraction – weight fraction – volume fraction– concentration of liquid solutions – molarity, molality, normality, ppm. Order of reaction-definition-limiting reactant, excess reactant, conversion, yield and selectivity. Energy balance -heat capacity- mean heat capacity – Kopp's rule - enthalpy change of phase changes –heat of mixing – heat effects accompanying chemical reactions-standard heat of formation.	**11**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Recall and classify the different components in food, distinguishing between nutrients and non-nutrient components	**K1**
CO2	Explain the engineering properties of food materials, including factors like density, viscosity, and elasticity.	**K2**
CO3	Utilize basic concepts of material and energy balance to solve problems related to food processing and production.	**K3**
CO4	Assess various principles of fluid mechanics as they apply to food processing systems, such as viscosity, flow rates, pressure drops, and pumping requirements.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Properties of Foods	Rao & Rizvi	CRC Press	2014 (4 Ed.)
2	Unit Operations in Chemical Engineering.	Warren McCabe, Julian Smith, Peter Harriott	Mc Graw Hill Book Co.	1993 (5Ed.)
3	Stoichiometry and process calculations	Narayanan, K. V. Lakshmikutty, B.	PHI Learning Pvt. Ltd	2016 (2Ed.)
4	Food Processing and Preservation	Sivasankar, B	Prentice – Hall of India Pvt. Ltd. New Delhi	2002

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Physical Properties of Plant and Animal materials	Nuri N Mohensin	Gordon and research science publishers	1986 (2 Ed.)
2	Basic Principles & Calculations in Chemical Engineering	David M. Himmelblau, James B. Riggs	PHI Learning Pvt. Ltd	2006 (7 Ed.)
3	Principles of Food Chemistry (Food Science Text Series)	John M. deMan, John W. Finley, W. Jeffrey Hurst, Chang Yong Lee	Springer	2018 (4 Ed.)

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/103107088
2	https://archive.nptel.ac.in/courses/126/105/126105011/
3	https://onlinecourses.nptel.ac.in/noc22_ch02/preview
4	https://onlinecourses.nptel.ac.in/noc22_ch02/preview

SEMESTER S1

ALGORITHMIC THINKING WITH PYTHON

(Common to All Branches)

Course Code	**UCEST105**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To provide students with a thorough understanding of algorithmic thinking and its practical applications in solving real-world problems.
2. To explore various algorithmic paradigms, including brute force, divide-and-conquer, dynamic programming, and heuristics, in addressing and solving complex problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	PROBLEM-SOLVING STRATEGIES: - Problem-solving strategies defined, Importance of understanding multiple problem-solving strategies, Trial and Error, Heuristics, Means-Ends Analysis, and Backtracking (Working backward). THE PROBLEM-SOLVING PROCESS: - Computer as a model of computation, Understanding the problem, Formulating a model, Developing an algorithm, Writing the program, Testing the program, and Evaluating the solution.	**7**

	ESSENTIALS OF PYTHON PROGRAMMING: - Creating and using variables in Python, Numeric and String data types in Python, Using the math module, Using the Python Standard Library for handling basic I/O - print, input, Python operators and their precedence.	
2	ALGORITHM AND PSEUDOCODE REPRESENTATION:- Meaning and Definition of Pseudocode, Reasons for using pseudocode, The main constructs of pseudocode - Sequencing, selection (if-else structure, case structure) and repetition (for, while, repeat-until loops), Sample problems* FLOWCHARTS** :- Symbols used in creating a Flowchart - start and end, arithmetic calculations, input/output operation, decision (selection), module name (call), for loop (Hexagon), flow-lines, on-page connector, off-page connector. * - *Evaluate an expression,* ***d=a+b*c****, find simple interest, determine the larger of two numbers, determine the smallest of three numbers, determine the grade earned by a student based on KTU grade scale (using if-else and case structures), print the numbers from 1 to 50 in descending order, find the sum of n numbers input by the user (using all the three loop variants), factorial of a number, largest of n numbers (****Not to be limited to these exercises. More can be worked out if time permits****).* *** Only for visualizing the control flow of Algorithms. The use of tools like RAPTOR (https://raptor.martincarlisle.com/) is suggested. Flowcharts for the sample problems listed earlier may be discussed*	**9**

3	SELECTION AND ITERATION USING PYTHON:- if-else, elif, for loop, range, while loop. Sequence data types in Python - list, tuple, set, strings, dictionary, Creating and using Arrays in Python (using Numpy library). DECOMPOSITION AND MODULARISATION* :- Problem decomposition as a strategy for solving complex problems, Modularisation, Motivation for modularisation, Defining and using functions in Python, Functions with multiple return values RECURSION:- Recursion Defined, Reasons for using Recursion, The Call Stack, Recursion and the Stack, Avoiding Circularity in Recursion, *Sample problems - Finding the **n**th Fibonacci number, greatest common divisor of two positive integers, the factorial of a positive integer, adding two positive integers, the sum of digits of a positive number* ***. * *The idea should be introduced and demonstrated using Merge sort, the problem of returning the top three integers from a list of **n>=3** integers as examples.* (***Not to be limited to these two exercises. More can be worked out if time permits***). ** ***Not to be limited to these exercises. More can be worked out if time permits***.	**10**
4	COMPUTATIONAL APPROACHES TO PROBLEM-SOLVING (*Introductory diagrammatic/algorithmic explanations only. Analysis not required*) :- Brute-force Approach - *Example: Padlock, Password guessing* Divide-and-conquer Approach - *Example: The Merge Sort Algorithm* Advantages of Divide and Conquer Approach - Disadvantages of Divide and Conquer Approach Dynamic Programming Approach *Example: Fibonacci series* - Recursion vs Dynamic Programming	**10**

	Greedy Algorithm Approach - *Example: Given an array of positive integers each indicating the completion time for a task, find the maximum number of tasks that can be completed in the limited amount of time that you have.* - Motivations for the Greedy Approach - Characteristics of the Greedy Algorithm - Greedy Algorithms vs Dynamic Programming Randomized Approach - *Example 1: A company selling jeans gives a coupon for each pair of jeans. There are n different coupons. Collecting **n** different coupons would give you free jeans. How many jeans do you expect to buy before getting a free one?* - *Example 2: **n** people go to a party and drop off their hats to a hat-check person. When the party is over, a different hat-check person is on duty and returns the **n** hats randomly back to each person. What is the expected number of people who get back their hats?* - Motivations for the Randomized Approach	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment (Accurate Execution of Programming Tasks)	Internal Examination-1 (Written Examination)	Internal Examination-2 (Written Examination)	Internal Examination- 3 (Lab Examination)	Total
5	5	10	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Utilize computing as a model for solving real-world problems.	**K2**
CO2	Articulate a problem before attempting to solve it and prepare a clear and accurate model to represent the problem.	**K3**
CO3	Utilize effective algorithms to solve the formulated models and translate algorithms into executable programs.	**K3**
CO4	Interpret the problem-solving strategies, a systematic approach to solving computational problems, and essential Python programming skills	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									3
CO2	3	3	3									3
CO3	3	3	3									3
CO4	3	3	3									3

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Problem solving & programming concepts	Maureen Sprankle, Jim Hubbard	Pearson	2012
2	How to Solve It: A New Aspect of Mathematical Method	George Pólya	Princeton University Press	2015
3	Creative Problem Solving: An Introduction	Donald Treffinger., Scott Isaksen, Brian Stead-Doval	Prufrock Press	2005
4	Psychology (Sec. Problem Solving.)	Spielman, R. M., Dumper, K., Jenkins, W., Lacombe, A., Lovett, M., & Perlmutter, M	H5P Edition	2021
5	Computer Arithmetic Algorithms	Koren, Israel	AK Peters/CRC Press	2018
6	Introduction to Computation and Programming using Python	Guttag John V	PHI	2/e., 2016
7	Python for Everyone	Cay S. Horstmann, Rance D. Necaise	Wiley	3/e, 2024
8	Computational Thinking: A Primer for Programmers and Data Scientists	G Venkatesh Madhavan Mukund	Mylspot Education Services Pvt Ltd	2020

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://opentextbc.ca/h5ppsychology/chapter/problem-solving/
2	https://onlinecourses.nptel.ac.in/noc21_cs32/preview

1. Continuous Assessment (5 Marks)

Accurate Execution of Programming Tasks

- Correctness and completeness of the program
- Efficient use of programming constructs
- Handling of errors
- Proper testing and debugging

2. Evaluation Pattern for Lab Examination (10 Marks)

1. **Algorithm (2 Marks)**

   Algorithm Development: Correctness and efficiency of the algorithm related to the question.

2. **Programming (3 Marks)**

   Execution: Accurate execution of the programming task.

3. **Result (3 Marks)**

   Accuracy of Results: Precision and correctness of the obtained results.

4. **Viva Voce (2 Marks)**

   Proficiency in answering questions related to theoretical and practical aspects of the subject.

Sample Classroom Exercises:

1. Identify ill-defined problem and well-defined problems
2. How do you differentiate the methods for solving algorithmic problems: introspection, simulation, computer modelling, and experimentation?
3. Use cases for Trial and error, Algorithm, Heuristic and Means-ends analysis can be applied in proffering solution to problems
4. Use a diagram to describe the application of Tower of Hanoi in choosing and analysing an action at a series of smaller steps to move closer to the goal
5. What effect will be generated if the stage that involves program writing is not observed in the problem-solving process?

6. What effect will be generated if the stage that involves program writing is not observed in the problem-solving process?
7. Evaluate different algorithms based on their efficiency by counting the number of steps
8. Recursive function that takes a number and returns the sum of all the numbers from zero to that number.
9. Recursive function that takes a number as an input and returns the factorial of that number.
10. Recursive function that takes a number 'n' and returns the nth number of the Fibonacci number.
11. Recursive function that takes an array of numbers as an input and returns the product of all the numbers in the list.

LAB Experiments:

1. Demonstrate about Basics of Python Programming
2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
3. Demonstrate different Arithmetic Operations on numbers in Python.
4. Create, concatenate, and print a string and access a sub-string from a given string.
5. Familiarize time and date in various formats (Eg. "Sun May 29 02:26:23 IST 2017")
6. Write a program to create, append, and remove lists in Python using numPy.
7. Programs to find the largest of three numbers.
8. Convert temperatures to and from Celsius, and Fahrenheit. [Formula: c/5 = f-32/9]
9. Program to construct the stars(*) pattern, using a nested for loop
10. Program that prints prime numbers less than 20.
11. Program to find the factorial of a number using Recursion.
12. Recursive function to add two positive numbers.
13. Recursive function to multiply two positive numbers
14. Recursive function to the greatest common divisor of two positive numbers.
15. Program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one

side equals the sum of the squares of the other two sides). Implement using functions.

16. Program to define a module to find Fibonacci Numbers and import the module to another program.
17. Program to define a module and import a specific function in that module to another program.
18. Program to check whether the given number is a valid mobile number or not using functions?

Rules:

1. Every number should contain exactly 10 digits.
2. The first digit should be 7 or 8 or 9

SEMESTER S1

FUNDAMENTALS IN BIOTECHNOLOGY LAB

Course Code	**GDBBL106**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:2:0	**ESE Marks (Internal only)**	50
Credits	1	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Lab

Course Objectives:

1. To introduce laboratory safety measures and familiarise the students with the basic concepts of biotechnology
2. To provide practical knowledge in analytical instruments used in biotechnology.

Expt. No.	**Experiments (Minimum 10 Experiments)**
1	Introduction to Biosafety in Laboratories
2	Basic concepts of preparing solutions (normality, molarity, molality)
3	Principles of sterile technique and cell propagation.
4	Preparation of buffers and determination of pH
5	Determination of specific gravity
6	Determination of refractive index of sugar solutions using refractometry.
7	Determination of specific rotation of sugar
8	Precision and validity of an experiment using absorption spectroscopy. • UV spectra of Nucleic Acids or Protein • Validate Beer's – Lambert law using potassium dichromate Absorption maxima.
9	Study of the stages of cell division using onion root tip
10	Isolation of an enzyme from a natural source.
11	Extraction of lipids from natural sources.
12	Immobilization of enzyme (gel entrapment)
13	Demonstration of a bioprocess fermenter

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Total
5	45	50

End Semester Examination Marks (ESE): (Internal evaluation only)

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified Lab record.

Pass Criteria:

- *A student must score a minimum of 50% overall, combining marks from both Continuous Internal Evaluation (CIE) and End Semester Examination (ESE).*
- ***In addition, the student must secure at least 40% in the End Semester Examination (ESE).***

The ESE shall be conducted internally, with evaluation carried out by a panel of faculty members. This panel must include at least one faculty member who was not involved in the Continuous Internal Evaluation (CIE) of the lab course.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the laboratory techniques, methodologies, instruments, and equipment following current laboratory safety protocol	**K2**
CO2	Understand basic analytical instruments	**K2**
CO3	Understand and use the microscope and observe the cell division	**K2**
CO4	Understand the parts and functioning of a bioreactor	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		2			2			2		2
CO2	2	2		2			2			2		2
CO3	2	2		2			2			2		2
CO4	2	2		2			2			2		2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Vogels text on Practical organic chemistry	Vogel, Arthur I.	Harlow: Longman	1996
2	Laboratory Manual in General Microbiology	Alfred Brown	McGraw Hill Publications	2004

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	An Introduction to Practical Biochemistry	David T. Plummer	McGraw-Hill	1998 3rd edn

Continuous Assessment (45 Marks)

1. **Preparation and Pre-Lab Work (10 Marks)**

   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (15 Marks)**

   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (10 Marks)**

   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (10 Marks)**

   - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.

- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S1

FOUNDATIONS OF FOOD TECHNOLOGY LAB

Course Code	**GDFTL106**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:2:0	**ESE Marks (Internal only)**	50
Credits	1	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Lab

Course Objectives:

1. To demonstrate the major properties of food
2. To study various equipment involved in food technology.

Expt. No.	**Experiments**
1	Estimation of Moisture Content by Hot Air Oven method.
2	Test for the presence of carbohydrates in the given food sample.
3	Test for the presence of protein in a given food sample.
4	Estimation of Physical parameters of water.
5	Determination of size, shape, sphericity, and roundness of food products.
6	Determination of firmness of given food product.
7	Determination of angle of repose and coefficient of friction of different food materials.
8	Determination of True density, bulk density, porosity, Hausner ratio, and Compressibility index of different food materials.
9	Determination of Reynold's number.
10	Measurement of the rate of flow of fluid using an Orifice meter.
11	Measurement of the rate of flow of fluid using a Venturi meter.
12	Demonstration of different types of pumps
13	Estimation of the concentration of the given solution in terms of molarity, molality & ppm.
14	Preparation of buffer solutions to ensure a stable pH in a chemical solution.
15	Standardization of acid and base solutions.
16	Determination of specific gravity and viscosity of the given sample.

Course Assessment Method (CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Total
5	45	50

End Semester Examination Marks (ESE): (Internal evaluation only)

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified Lab record.*

Pass Criteria:

- *A student must score a minimum of 50% overall, combining marks from both Continuous Internal Evaluation (CIE) and End Semester Examination (ESE).*
- ***In addition, the student must secure at least 40% in the End Semester Examination (ESE).***

The ESE shall be conducted internally, with evaluation carried out by a panel of faculty members. This panel must include at least one faculty member who was not involved in the Continuous Internal Evaluation (CIE) of the lab course.

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the basic principles of Food Science	**K2**
CO2	Comprehend on the basic engineering properties of food	**K2**
CO3	Apply the basic concepts of Flow properties	**K3**
CO4	Apply the basic concepts of process calculations.	**K3**
CO5	Understand the basic principles of Food Science	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2		2	3	3		3
CO2	3					2		2	3	3		3
CO3	3					2		2	3	3		3
CO4	3					2		2	3	3		3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Food Chemistry	H.-D. Belitz, Werner Grosch, and Peter Schieberle	Springer	4th revised edition
2	Food Processing: Principles and Applications	Stephanie Clark, Stephanie Jung, and Buddhi Lamsal	Wiley Blackwell	Second edition

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Food Analysis	S Suzainne Nielson	Springer	4th edition
2	Handbook of Food and Nutrition	M. Swaminathan	Bappco	2018 edition

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://nptel.ac.in/courses/103107088

Continuous Assessment (45 Marks)

1. Preparation and Pre-Lab Work (10 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (15 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (10 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (10 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Evaluation Pattern for End Semester Examination (50 Marks)

6. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

7. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

8. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

9. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

10. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S1/S2

HEALTH AND WELLNESS

(Common to all Groups)

Course Code	**UCHWT127**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	1:0:1:0	**ESE Marks**	0
Credits	1	**Exam Hours**	Nil
Prerequisites (if any)	None	**Course Type**	

Course Objectives:

1. To provide essential knowledge on physical activity, health, and wellness.
2. To ensure students understand body systems, exercise principles, nutrition, mental health, and disease management.
3. To educate students on the benefits of yoga, the risks of substance abuse and basic first aid skills.
4. To equip students with the ability to lead healthier lifestyles.
5. To enable students to design effective and personalized exercise programs.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the Human Body. Quantifying Physical Activity Energy Expenditure and Metabolic equivalent of task (MET) Exercise Continuum: Light-intensity physical activity, Moderate - intensity physical activity, Vigorous -intensity physical activity. Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme	**4**

	Components of Health related Physical Fitness : - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	
2	Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health. Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	**2**
3	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - Cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes - Osteoporosis - Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis , flat foot, Knock knee) Meaning, Aims and objectives of yoga - Classification and importance of of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative - Cocaine - Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	**4**
4	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver -	**2**

	Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	

Additional Topics

- Need and Importance of Physical Education and its relevance in interdisciplinary context. Understanding of the Endocrine System
- Developing a fitness profile
- Healthy foods habits for prevention and progression of Lifestyle Diseases. Processed foods and unhealthy eating habits.
- Depression - Anxiety - Stress
- Different ways of carrying an injured person. Usage of Automated external defibrillator

Course Assessment Method
(CIE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Case Study/Micro project/Presentation	Activity evaluation	Total
10	**20**	**20**	**50**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the different human body systems and describe various types of physical activities along with methods to measure and quantify these activities.	**K2**
CO2	Explain how to maintain or improve health and wellness through psychological practices, dietary habits, and sports activities.	**K2**
CO3	Discuss about common hypokinetic disorders and musculoskeletal disorders, and describe the importance of leading a healthy lifestyle through the practice of yoga and abstaining from addictive substances.	**K2**
CO4	Explain the basics of first aid and describe common sports injuries	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2		3		3	3	2		2
CO2				2		3		2	2			2
CO3				0		3		3				2
CO4				2		3						2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Foundations of Nutrition	Bhavana Sabarwal	Commonwealth Publishers	1999
2	Anatomy and physiology in health and illness.	Ross and Wilson	Waugh, A., & Grant, A.	2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fit to be Well Essential Concept	Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S.	Jones & Bartlett Learning.	2018
2	Introduction to physical education, fitness, and sport.	Siedentop, D., Van der Mars, H.	Human kinetics.	2022
3	Substance Use Disorders. Manual for Physicians.	Lal, R., & Ambekar, A. (2005).	National Drug Dependence Treatment Centre, New Delhi	2005
4	The exercise health connection-how to reduce your risk of disease and other illnesses by making exercise your medicine.	Nieman, D. C., White, J. A	Public Health	1998
5	ACSM's resource manual for guidelines for exercise testing and prescription.	Lippincott Williams & Wilkins.	American College of Sports Medicine.	2012
6	Exercise Physiology: energy, nutrition and human performance.	Katch, F. I., Katch, V. L., & McArdle, W. D.	Lippincott Williams & Wilkins	2010

Continuous Internal Evaluation Marks (CIE): for the Health and wellness course

Students will be evaluated as follows.

Title	Method of Evaluation
Attendance	Students must attend at least 75% of both theory and practical classes. They will receive 10 marks based on their class attendance. Students who do not meet the minimum attendance requirement for a course, as specified in the B. Tech regulations, will not be eligible to proceed to the next criteria.

Assignment / Presentation	Assignments will be given to students to assess their understanding of the subjects taught. Students will be required to make presentations on the subjects taught in class, and their understanding of the subjects will be assessed. Based on the Assignments and Presentations the students will be awarded marks out of 20
Activity Evaluation	The Assignment / Presentation faculty handling the class will use the tests from the Fitness Protocols and Guidelines for ages 18+ to 65 years, as set forth by FIT India. Measurements will be taken for all the tests of the FIT India Fitness Protocol and the evaluation will be based on the benchmark score received for the following tests: 1. V Sit Reach Test 2. Partial Curl Up - 30 seconds 3. Push Ups (Male) and Modified Push Up (Female) 4. Two (2) Km Run/Walk Students who achieve a total benchmark score of 8 across the aforementioned 4 tests will be awarded pass marks for activity evaluation. Students who score better will be awarded a maximum mark of 20.
Activity Evaluation - Special Circumstances	Physically challenged and medically unfit students can opt for an objective test to demonstrate their knowledge of the subjects taught. Based on their performance in the objective test, they will be awarded marks out of 20.
Activity Evaluation - Special Considerations - NCC	Students who enrolled themselves in the NCC during the course period (between the start and end dates of the program) and attended 5 college level parades will be awarded pass marks for activity evaluation. Students who attend more parades will be eligible for a maximum mark of 20 based on their parade attendance.

Tests to evaluated as per Criterion - 2 and Benchmark Scores

V Sit Reach Test

How to Perform:

1. The subject removes their shoes and sits on the floor with the measuring line between their legs and the soles of their feet placed immediately behind the baseline, heels 8-12" apart.

2. The thumbs are clasped so that hands are together, palms facing down and placed on the measuring line.

3. With the legs held flat by a partner, the subject slowly reaches forward as far as possible, keeping the fingers on baseline and feet flexed.

4. After three tries, the student holds the fourth reach for three seconds while that distance is recorded.

5. Make sure there are no jerky movements, and that the fingertips remain level and the legs flat.

Infrastructure/Equipment Required:

1. A tape for marking the ground, marker pen, and ruler.

2. With the tape mark a straight line two feet long on the floor as the baseline, and a measurement line perpendicular to the midpoint of the baseline extending two feet on each side.

3. Use the marker pen to indicate every centimeter and millimeter along the measurement line. The point where the baseline and the measuring line intersect is the zero point.

Scoring: The score is recorded in centimeters and millimeters as the distance reached by the hand, which is the difference between the zero point (where the baseline and measuring line intersect) and the final position.

Scoring for V Sit Reach Test for Males

Level	Benchmark Score	Measurement (cm)
1	2	<11
2	4	12-13
3	6	14-17
4	7	18-19
5	8	20-21
6	9	22
7	10	>22

Scoring for V Sit Reach Test for Females

Level	Benchmark Score	Measurement (cm)
1	2	<14
2	4	15-16
3	6	17-19
4	7	20-21
5	8	22
6	9	23
7	10	>23

Partial Curl Up – 30 seconds

How to Perform:

1. The subject lies on a cushioned, flat, clean surface with knees flexed, usually at 90 degrees, with hands straight on the sides (palms facing downwards) closer to the ground, parallel to the body.

2. The subject raises the trunk in a smooth motion, keeping the arms in position, curling up the desired amount (at least 6 inches above/along the ground towards the parallel strip).

3. The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor.

Infrastructure/Equipment Required:

Flat clean cushioned surface with two parallel strips (6 inches apart), Stopwatch

Scoring: Record the maximum number of Curl ups in a certain time period 30 seconds.

Scoring for Partial Curl Up - 30 seconds Test for Males

Level	Benchmark Score	Numbers
1	2	<25
2	4	25-30
3	6	31-34
4	7	35-38
5	8	39-43
6	9	44-49
7	10	>49

Scoring for Partial Curl Up - 30 seconds Test for Females

Level	Benchmark Score	Numbers
1	2	**<18**
2	4	18-24
3	6	25-28
4	7	29-32
5	8	33-36
6	9	37-43
7	10	>43

Push Ups for Male/Modified Push Ups for Female How to Perform:

1. A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angle to the body.

2. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended.

3. This action is repeated, and the test continues until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups.

4. For Female: push-up technique is with the knees resting on the ground.

Infrastructure/Equipment Required:

Flat clean cushioned surface/Gym mat

Scoring: Record number of correctly completed pushups.

Scoring for Push Ups for Male

Level	Benchmark Score	Numbers
1	2	<4
2	4	04- 10
3	6	11 -18
4	7	19-34
5	8	35-46
6	9	47-56
7	10	>56

Scoring for Modified Push Ups for Female

Level	Benchmark Score	Numbers
1	2	0-1
2	4	2 - 5
3	6	6 -10
4	7	11 - 20
5	8	21-27
6	9	27-35
7	10	>35

2 Km Run/Walk

How to Perform:

1. Participants are instructed to run or walk 2 kms in the fastest possible pace.

2. The participants begin on signal (Starting point)- "ready, start". As they cross the finish line, elapsed time should be announced to the participants.

3. Walking is permitted but the objective is to cover the distance in the shortest possible time.

Infrastructure/Equipment Required:

Stopwatch, whistle, marker cone, lime powder, measuring tape, 200 or 400 m with 1.22 m (minimum 1 m) width preferably on a flat and even playground with a marking of starting and finish line. You can also use any application on your mobile phone that tells you the distance.

Scoring: Time taken for completion (Run or Walk) in min, sec.

Scoring for 2Km Run/walk for Male

Level	Benchmark Score	Minutes: Seconds
1	2	> 11:50
2	4	10:42
3	6	09:44
4	7	08:59
5	8	08:33
6	9	07:37
7	10	>07:37

Scoring for 2Km Run/walk for Female

Level	Benchmark Score	Minutes : Seconds
1	2	>13:47
2	4	12:51
3	6	12:00
4	7	11:34
5	8	10:42
6	9	09:45
7	10	>09:45

SEMESTER - S1/S2

LIFE SKILLS AND PROFESSIONAL COMMUNICATION
(Common to all Branches)

Course Code	**UCHUT128**	**CIE Marks**	100
Teaching Hours/Week (L: T:P: R)	2:0:1:0	**ESE Marks**	0
Credits	1	**Exam Hours**	-
Prerequisites (if any)	None	**Course Type**	Activity-based learning

Course objectives:

1. To foster self-awareness and personal growth, enhance communication and interpersonal connection skills, promote effective participation in groups and teams, develop critical thinking, problem-solving, and decision-making skills, and cultivate the ability to exercise emotional intelligence.
2. To equip students with the necessary skills to listen, read, write & speak, to comprehend and successfully convey any idea, technical or otherwise.
3. To equip students to build their profile in line with the professional requirements and standards.

Continuous Internal Evaluation Marks (CIE):

- Continuous internal evaluation is based on the individual and group activities as detailed in the activity table given below.
- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. They should use online collaboration tools for group activities, report/presentation making and work management.
- Activities are to be distributed between 3 class hours (2L+1P) and 3.5 Self-study hours.
- Marks given against each activity should be awarded fully if the students successfully complete the activity.
- Students should maintain a portfolio file with all the reports and other textual materials generated

from the activities. Students should also keep a journal related to the activities undertaken.

- Portfolio and journal are mandatory requirements for passing the course, in addition to the minimum marks required.
- The portfolio and journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through the HMC courses and Mini project course.
- Self-reflection questionnaire shall be given at the beginning of the semester, in between and at the end of the semester based on the guidelines in the manual of the course

Table 1: Activity Table

Sl. No.	Activity	Class room (L) / Self Study (SS)	Week of completion	Group / Individual (G/I)	Marks	Skills	CO
1.1	Group formation and self-introduction among the group members	L	1	G	-	• Connecting with group members • Time management - Gantt Chart	
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	1	G	-		
1.3	Preparation of Gantt chart based on the time plan	SS	1	G	2		
2.1	Take an online personality development test, self-reflect and report	SS	1	I	2	• Self-awareness Writing	CO1
2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their ● Strengths, ● Areas for improvement, ● Concerns, ● Areas in which he/she hesitates to take advice, ● Goals/Expectations, from the point of view of the following assumed roles	L	1	I	2	●Goal setting - Identification of skills and setting goal ●Self-awareness ●Discussion in groups ●Group work- Compiling of ideas • Mind mapping	CO1

	i) their parent/guardian/mentor ii) their friend/sibling/cousin						
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about the ● Skills required as a B. Tech graduate ● Attitudes, habits, approaches required and activities to be practised during their B. Tech years, in order to achieve the set goals	SS	1	I	2		CO1
2.4	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role-storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	● Empathy	CO2
4.1	Each student connects and networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (at least 1 through LinkedIn)	SS	3	I	2	• Workplace awareness • Listening • Communication - interacting with people • Networking through various media including LinkedIn • Discussion in groups • Report preparation • Creativity Goal setting - Preparation of action plan	
4.2	Interact with them to understand their workplace details including ● workplace skills required ● their work experience ● activities they have done to enhance their employability during their B. Tech years ● suggestions on the different activities to be done during B. Tech years Prepare a documentation of this	SS	3	I	4		CO2
4.3	Discuss the different workplace details &						CO2

	work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	SS	3	G	2		
4.4	Report preparation based on the discussions	SS	4	G	3		CO4
4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L	5	G	4		CO3
4.6	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	SS	5	I	2		CO1
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L	6	G	2		CO3
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	SS	6	I	2		CO4
5.3	Use any online tech forum to gather ideas for solving the problem chosen	SS	6	G	2		CO5
5.4	Arrive at a possible solution using six thinking hat exercise	L	7	G	3		CO3
5.5	Prepare a report based on the problem-solving experience	SS	7	G	2		CO4
6.1	Linkedin profile creation	SS	1	I	2		CO6
6.2	Resume preparation	SS	8	I	2	Profile-building	CO6
6.3	Self-introduction video	SS	8	I	3		CO6
7	Prepare a presentation on instances of demonstration of emotional intelligence	SS	9	I	2	Emotional intelligence	CO2
8	Prepare a short video presentation on diversity aspects observed in our	SS	10	G	3	Diversity	CO2, CO5

	society (3 to 5 minutes)						
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	SS	10	I	2	• Interview skills	CO6
10	Take an online listening test, self-reflect and report	SS	11	I	2	Listening skills	CO6
11.1	Activities to improve English vocabulary of students	L	8	I/G	4	• English vocabulary • English language skills • Writing • Presentation • Group work • Self-reflection	CO4
11.2	Activities to help students identify errors in English language usage	L	9	I/G	2		CO4
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L	10	I/G	2		CO4
11.4	Write a self-reflection report on the improvement in English language communication through this course	SS	12	I	2		CO4
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L	11 to 12	G	2		CO4, CO5
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies	SS	12	G	4	• Audio-visual presentations creations with the use of technology tools • Effective use of social media platforms • Profile building	CO2, CO4, CO5
12.2	Upload the video content to podcasting platforms or YouTube	SS	12	G	1		CO5
12.3	Add the link of the podcast in their LinkedIn profile	SS	12	G	1		CO5

Table 2: Lab hour Activities (P): 24 Marks

Sl No	Activity	Marks	Skill	CO
1	Hands-on sessions on day-to-day engineering skills and a self-reflection report on the experience gained: 1. Drilling practice using electric hand drilling machines. 2. Cutting of MS rod and flat using electric hand cutters. 3. Filing, finishing and smoothening using electrically operated hand grinders. 4. MS rod cutting using Hack saw by holding the work in bench wise. 5. Study and handling different types of measuring instruments. 6. Welding of MS, SS work pieces. 7. Pipe bending practice (PVC and GI). 8. Water tap fitting. 9. Water tap rubber seal changing practice. 10. Union and valves connection practice in pipes. 11. Foot valve fitting practice. 12. Water pump seal and bearing changing practice.	**24**	Basic practical engineering skills	**3**
2	Language Lab sessions	**-**	Language Skills	**4**

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Develop the ability to know & understand oneself, show confidence in one's potential & capabilities, set goals and develop plans to accomplish tasks	**K5**
CO2	Develop the ability to communicate and connect with others, participate in groups/teams, empathise, respect diversity, be responsible and understand the need to exercise emotional intelligence	**K5**
CO3	Develop thinking skills, problem-solving and decision-making skills	**K5**
CO4	Develop listening, reading, writing & speaking skills, ability to comprehend & successfully convey any idea, and ability to analyze, interpret & effectively summarize textual, audio & visual content	**K6**
CO5	Develop the ability to create effective presentations through audio-visual mediums with the use of technology tools and initiate effective use of social media platforms & tech forums for content delivery and discussions	**K6**
CO6	Initiate profile-building exercises in line with the professional requirements, and start networking with professionals/academicians	**K6**

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1										1		3
CO2					1			3		3		3
CO3		1	1		1					1		1
CO4					1					1		2
CO5					1	1				1		2
CO6					1					1		

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press	First Edition, 2022
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury, Publishing PLC	25th Anniversary Edition December 2020
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business	September 2023
4	Deep Work: Rules for focused success in a distracted world	Cal Newport	PIATKUS	January 2016
5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
6	Interchange	Jack C. Richards, With Jonathan Hull, Susan Proctor	Cambridge publishers	5th Edition

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Life Skills for Engineers	Remesh S., Vishnu R.G.	Ridhima Publications	First Edition, 2016
2	Soft Skills & Employability Skills	Sabina Pillai and Agna Fernandez	Cambridge University Press	First Edition, 2018
3	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
4	English Grammar in Use	Raymond Murphy,	Cambridge University Press India PVT LTD	5th Edition 2023
5	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey. New York	2004

SEMESTER 2

GROUP D

SEMESTER S2

MATHEMATICS FOR LIFE SCIENCE - 2

Course Code	**GDMAT201**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Basic knowledge in calculus.	**Course Type**	Theory

Course Objectives:

1. Equip students with fundamental concepts of complex numbers.
2. Provide a robust understanding of Taylor and Maclaurin series expansions for approximating functions and solving boundary value problems.
3. Familiarize students with analytical techniques for solving differential equations and computing power series coefficients.
4. Introduce advanced concepts and methods in Laplace transform relevant to engineering contexts.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Complex numbers and their geometric representation- addition, subtraction, multiplication, division, conjugate. Polar form of complex numbers, Derivative - Analytic function, Cauchy Riemann equation, Exponential function, Trigonometric and hyperbolic functions - Euler's formula. **(Text1: Relevant topics from Sections 13.1,13.2,13.3,13.4,13.5,13.6)**	**9**
2	Power series - Concept behaviour of convergence of Power series- Radius of convergence. Taylor and Maclaurin series - Binomial series-Series representation of exponential - trigonometric - logarithmic functions. Fourier series , Euler formulas, Convergence of Fourier series (Dirichlet's	**9**

	conditions), Fourier series of function with period $2l$. **(Text 1: Relevant topics from Sections 11.1 ,11.2, 15.2,15.4)**	
3	Homogeneous linear ODEs of second order with constant coefficients (Method to find general solution, solution of linear Initial Value Problem). Non homogenous ODEs (with constant coefficients)- General solution, Particular solution by the method of undetermined coefficients (Particular solutions for the functions $ke^{\gamma x}$, kx^n, $k\cos\omega x$, $k\sin\omega x$, $ke^{\alpha x}\cos\omega x$, $ke^{\alpha x}\sin\omega x$) **(Text 1: Relevant topics from sections 2.2, 2.7)**	
4	Laplace Transform, Inverse Laplace Transform, Linearity property, First shifting theorem, Transform of derivatives, Solution of Initial value problems by Laplace transform (Second order linear ODE with constant coefficients with initial conditions at t=0 only). **(Text 1: Relevant topics from Sections 6.1,6.2)**	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the concept of complex numbers and analytic functions	**K2**
CO2	Understand the concept of series expansions of functions and to calculate Fourier series	**K2**
CO3	Solve homogeneous and non-homogeneous linear differential equations with constant coefficients.	**K3**
CO4	Compute Laplace transform of functions and solve ODEs arising in engineering problems.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	2
CO3	3	3	-	2	-	-	-	-	-	-	-	2
CO4	3	3	-	2	-	-	-	-	-	-	-	2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10^{th} edition, 2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson	15th edition , 2024
2	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis Group	9th edition, 2021
3	Calculus	Howard Anton, Irl Bivens, Stephen Davis	Wiley	12th edition, 2024
4	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023

Module. No	Link ID
1	https://archive.nptel.ac.in/courses/111/103/111103070/
2	https://onlinecourses.nptel.ac.in/noc23_ma64/preview
3	https://archive.nptel.ac.in/courses/111/104/111104031/
4	https://archive.nptel.ac.in/courses/111/106/111106139/

SEMESTER S1/S2

PHYSICS FOR PHYSICAL SCIENCE AND LIFE SCIENCE (Common to Group C & D)

Course Code	**GZPHT121**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory + Lab

Course Objectives:

1. To provide students with a solid background in the fundamentals of Physics and impart this knowledge in Physical Science and Life Science disciplines.
2. To develop scientific attitudes and enable students to correlate Physics concepts with their core programs.
3. To equip students with practical knowledge that complements their theoretical studies and develop their ability to create practical applications and solutions in engineering based on their understanding of Physics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Laser & Fiber Optics** Optical processes – Absorption-Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing – Population inversion- Pumping-Metastable states, Basic components of laser - Active medium - Optical resonant cavity, Construction and working of Ruby laser and CO2 laser, Construction and working Semiconductor laser (qualitative), Properties of	**9**

	laser, Applications of laser. Optic fiber-Principle of propagation of light, Types of fibers- Step index and Graded index fibers - Multimode and single mode fibers, Acceptance angle, Numerical aperture – Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	
2	**Interference and Diffraction** Introduction, Principle of super position, Constructive and destructive interference, Optical path, Phase difference and path difference, Cosine law- reflected system- Condition for constructive and destructive interference, Colours in thin films, Newton's Rings-Determination of refractive index of transparent liquids and wavelength, Air wedge- Measurement of thickness of thin sheets. Diffraction-types of diffraction, Diffraction due to a single slit, Diffraction grating – Construction - grating equation, Dispersive and Resolving Power (qualitative).	**9**
3	**Quantum Mechanics** Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle- Absence of electron inside nucleus - Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (qualitative)	**9**

4	**Waves & Acoustics** Waves- transverse and longitudinal waves, Concept of frequency, wavelength and time period (no derivation), Transverse vibrations in a stretched string- derivation of velocity and frequency - laws of transverse vibration. Acoustics- Reverberation and echo, Reverberation time and its significance - Sabine's Formula, Factors affecting acoustics of a building. Ultrasonics- Piezoelectric oscillator, Ultrasonic diffractometer, SONAR, NDT-Pulse echo method, medical application-Ultrasound scanning (qualitative)	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment	Internal Examination- 1 (Written)	Internal Examination - 2 (Written)	Internal Examination- 3 (Lab Examination)	Total
5	**10**	**10**	**10**	**5**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Describe the basic principles and properties of laser and optic fibers.	**K2**
CO2	Describe the phenomena of interference and diffraction of light.	**K2**
CO3	Describe the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics.	**K2**
CO4	Apply the knowledge of waves and acoustics in non-destructive testing and in acoustic design of buildings.	**K3**
CO5	Apply basic knowledge of principles and theories in physics to conduct experiments.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											3
CO2	3											3
CO3	3											3
CO4	3	3										3
CO5	3	3			3				2			3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A Textbook of Engineering Physics	M N Avadhanulu, P G Kshirsagar & TVS Arun Murthy	S Chand & Co.	2nd Edition, 2019
2	Engineering Physics	H K Malik , A.K. Singh,	McGraw Hill Education	2nd Edition, 2017
3	Optics	Ajoy Ghatak	Mc Graw Hill Education	6th Edition, 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Physics	G Vijayakumari	Vikas Publications	8th Edition, 2014
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Edition 2003
3	Engineering Physics	Aruldhas G.	PHI Pvt. Ltd	2nd Edition, 2015
4	Fiber Optic Communications	Gerd Keiser	Springer	2021
5	A Text Book of Engineering physics	I. Dominic, A. Nahari	OWL Publications	2nd Edition, 2016
6	Advanced Engineering Physics	Premlet B	Phasor Books	
7	Engineering Physics	Rakesh Dogra	Katson Books	1st Edition, 2019

Video Links (NPTEL, SWAYAM…)	
Module No	**Link ID**
1	https://nptel.ac.in/courses/115102124 https://nptel.ac.in/courses/104104085
2	https://nptel.ac.in/courses/115105537
3	https://nptel.ac.in/courses/115102023 https://nptel.ac.in/courses/115101107
4	https://nptel.ac.in/courses/112104212 https://nptel.ac.in/courses/124105004

1. **Continuous Assessment (10 Marks)**

   1. **Preparation and Pre-Lab Work (2 Marks)**

      - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
      - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

   2. **Conduct of Experiments (2 Marks)**

      - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
      - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
      - Teamwork: Collaboration and participation in group experiments.

   3. **Lab Reports and Record Keeping (3 Marks)**

      - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
      - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

   4. **Viva Voce (3 Marks)**

      - Oral Examination: Ability to explain the experiment, results and underlying

principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

2. Evaluation Pattern for Lab Examination (5 Marks)

1. Procedure/Preliminary Work/Conduct of Experiments (2 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Setup and Execution: Proper setup and accurate execution of the experiment or programming task

2. Result (2 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.

3. Viva Voce (1 Marks)

- Proficiency in answering questions related to theoretical and practical aspects of the subject.

Experiment List

Experiment No.	Experiments (Minimum 10 Experiments)
1	Optical fiber characteristics- Measurement of Numerical aperture.
2	Determination of wavelength of Laser using diffraction grating.
3	Measure the wavelength of Laser using a millimetre scale as a grating.
4	Determination of wavelength of a monochromatic light using Newton's Rings method.
5	Determination of diameter of wire or thickness of thin sheet using Air wedge method.
6	Determination of slit width (diffraction due to a single slit).
7	Measure wavelength of light source using diffraction grating.
8	Determination of resolving power and dispersive power of grating.
9	Characteristics of LED.
10	CRO basics-Measurement of frequency and amplitude of wave forms.
11	Solar Cell- I V and Intensity Characteristics.
12	Melde's experiment- Frequency calculation in Transverse and Longitudinal Mode.
13	LCR circuit –forced and damped harmonic oscillations.
14	Determination of wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.
15	Determination of particle size of lycopodium powder.

SEMESTER S1/S2

CHEMISTRY FOR LIFE SCIENCE

(Common to Group D)

Course Code	**GDCYT122**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To equip students with a thorough understanding of chemistry concepts relevant to engineering applications.
2. Familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. Raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on quality of life.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Stereochemistry & Materials for Biological Applications** **Stereochemistry:** Stereo Isomerism-Configurational Isomerism-Geometrical & Optical isomers-Wedge & Fischer projections - E-Z Nomenclature- R&S Configuration **Nanomaterials:** Classification based on materials- Synthesis – Sol gel & Chemical reduction – Bio-applications of nanomaterials – Carbon Nanotubes, Fullerenes & Graphene – structure, properties & application. **Polymers:** Biodegradable polymers- PHBV & PLA- Synthesis, properties and applications. Conducting Polymers-Classification-Polyaniline & Polypyrrole- Synthesis, properties and applications	**9**

	(Biosensors & artificial muscles). Nano polymers-Dendrimers – biological application.	
2	**Electrochemistry and Corrosion Science** Electrochemical Cell: Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE & Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode & pH Measurement-Conductivity- Measurement using Digital conductivity meter. Li-ion battery & H_2-O_2 fuel cell (acid electrolyte only) construction and working. Corrosion control methods: Galvanic series - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection – Electroplating of copper - Electroless plating of copper.	**9**
3	**Instrumental Methods of Analysis** **Spectroscopy:** Types of spectra - Molecular energy levels - Beer Lambert's law – Numerical problems - Electronic Spectroscopy – Principle, Types of electronic transitions – Role of conjugation in absorption maxima- Instrumentation-Applications – Vibrational spectroscopy – Principle- Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications **Chromatographic methods:** Basic principles and applications of column and TLC-Retention factor. HPLC-Principle, instrumentation (block diagram) - retention time and applications. **Electron Microscopic Techniques:** SEM - Principle, instrumentation and Applications. **Fuels**: Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels. Biofuels- Biodiesel-Green Hydrogen.	**9**

4	**Environmental Chemistry** **Water characteristics**: - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Degree of hardness (Numericals) Water softening methods-Ion exchange process- Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. – Water disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation. Dissolved oxygen (DO) -Estimation (only brief procedure- Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). **Waste Management**: Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Chemistry of climate change- Greenhouse Gases-Ozone depletion - Sustainable Development- An introduction to Sustainable Development Goals.	**9**

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Internal Examination- 3 (Lab Examination)	Total
5	**10**	**10**	**10**	**5**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the use of various materials and their stereochemical influence in Biological applications	**K2**
CO2	Explain the Basic Concepts of Electrochemistry and Corrosion to Explore the Possible Applications in Various Engineering Fields	**K2**
CO3	Choose appropriate analytical techniques for different engineering materials	**K3**
CO4	Outline various water treatment and waste management methods	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	3										2
CO3	3	3										2
CO4	3	3				2	3					2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition-2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition-2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17th Edition - 2015

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4th edn., 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials: Synthesis, Properties and Applications	Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham	Wiley-VCH Verlag GmbH & Co. KGaA	2014
6	Organic Electronics Materials and Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications of Thermal Analysis	Gabbot, P	Oxford: Blackwell Publishing	2008

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/104/106/104106137/ https://archive.nptel.ac.in/courses/113/105/113105102/ https://archive.nptel.ac.in/courses/113/104/113104082/ https://www.youtube.com/watch?v=BeSxFLvk1h0
2	https://archive.nptel.ac.in/courses/113/104/113104102/ https://archive.nptel.ac.in/courses/104/105/104105124/ https://archive.nptel.ac.in/courses/105/104/105104157/

Continuous Assessment (10 Marks)

Continuous assessment evaluations are conducted based on laboratory associated with the theory.

Mark distribution

1. **Preparation and Pre-Lab Work (2 Marks)**
   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (2 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (3 Marks)**
   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.

- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for Lab Examination (5 Marks)

1. **Procedure/Preliminary Work/Conduct of Experiments (2 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
   - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

2. **Result (2 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.

3. **Viva Voce (1 Marks)**
   - Proficiency in answering questions related to theoretical and practical aspects of the subject.

List of Experiments

Minimum 10 Experiments

Expt. Nos.	Experiment
1	Estimation of iron in iron ore
2	Estimation of copper in brass
3	Determination of cell constant and conductance of solutions
4	Calibration of pH meter and determination of pH of a solution
5	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
6	Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
7	Determination of molar absorptivity of a compound (KMnO4 or any water-soluble food colorant)
8	Analysis of IR spectra
9	Identification of drugs using TLC
10	Estimation of total hardness of water-EDTA method
11	Estimation of dissolved oxygen by Winkler's method
12	Determination of calorific value using Bomb calorimeter
13	Determination of saponification value of a given vegetable oil
14	Determination of acid value of a given vegetable oil
15	Verification of Nernst equation for electrochemical cell.

SEMESTER S2

BASIC MECHANICAL AND CIVIL ENGINEERING

Course Code	**GDEST203**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-0-0-0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Understand thermodynamic cycles and the working of IC engines.
2. Understand the refrigeration cycles and psychrometric concepts
3. To understand the relevance of civil engineering and its various disciplines.
4. Explain the relevance of various building codes and types of buildings as per the codes.
5. Understand various types of building components and building materials.
6. Understand the concept of environmental systems through ecological contexts.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	General Introduction to Mechanical Engineering Thermodynamic cycles -Carnot Cycle -Derivation of efficiency (problems on efficiency) Otto, Diesel cycles (no derivation of efficiency and problems). IC Engines: CI & SI Engines, working of 2-Stroke & 4-Stroke engines. Listing the parts of IC Engines. Concept of CRDI, MPFI, and hybrid engines. Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapor compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity, and relative humidity, Psychrometric chart, Cooling and	**9**

	dehumidification, Layout of central air conditioning systems	
2	Classification of pumps, Description about working with sketches of Reciprocating pump, Centrifugal pump. Classification of Hydraulic Turbines. Different types of gears and their applications (spur, helical, bevel, worm, and worm wheel), List types of clutches and their use, Bearings and their classification (Journal bearing and ball bearing) Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, SMAW, Soldering and Brazing and their applications. Machining processes: Description and operations performed on Lathe, Drilling machine, Milling machine, CNC machine, 3D printing.	**9**
3	Relevance of Civil Engineering in the overall infrastructural development of the country. A brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering, and Environmental Engineering. Introduction to buildings: Types of buildings according to the character of occupancy as per NBC, Load bearing and non-load bearing building structures, components, and functions. (concept only). Selection of site for a residential building, Building Area Definitions: Built-up area, Plinth area, Floor area, Carpet area, and Floor area ratio or a building as per KBR. Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion of relevance only). Environmental Laws and Regulations: Overview of environmental laws (Brief Description only)	**9**

4	Origin of soil-weathering of rocks, types of weathering Conventional construction materials: Brick, stones, sand, cement, and timber- Classification of construction materials, Qualities, tests and uses of construction materials, Cement concrete: Constituent materials, properties, and types. – Steel: Structural steel sections and steel reinforcements - types. Environmental Systems and Sustainable Practices: Pollution control technologies, Sustainable Development and Renewable Energy, Basics of climate change and mitigation strategies (brief description only)	**9**

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the relevance of mechanical engineering and its various disciplines.	**K2**
CO2	Learn the applications of thermodynamics through IC engines and refrigeration systems.	**K2**
CO3	Understand the various manufacturing processes adapted by mechanical engineers.	**K2**
CO4	Understand the relevance of civil engineering and its various disciplines.	**K2**
CO5	Describe the relevance of various building codes and types of buildings as per the codes.	**K2**
CO6	Understand various types of building components and building materials.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3											
CO2	3											
CO3	3											2
CO4	2					2						2
CO5	2					2	2					2
	2					2	3					2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Basic Mechanical Engineering	Pravin Kumar	Pearson Education	1st Edition, 2013
2	A Textbook of Basic Mechanical Engineering	R.K. Rajput	Laxmi Publications	3rd Edition, 2017
3	Elements of Mechanical Engineering	K.P. Roy, S.K. Hajra Choudhury, A.K. Hajra Choudhury	Media Promoters & Publishers Pvt. Ltd.	Revised Edition, 2012
4	Engineering Materials (Material Science)	S C Rangwala	Charotar Publishing House Pvt Limited	43rd Edition 2019
5	Building Materials	S K Duggal	New Age International	5t Edition 2019
6	Essentials of Civil Engineering	Dalal, K R	Charotar Publishing house	Ist Edition 2012
7	Essential Environmental studies	Kurian Joseph & R Nagendran	Pearson Education, New Delhi	1st Edition 2005

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	Chris Mi and M. Abul Masrur	John Wiley & Sons	2nd Edition, 2017
2	Automotive Engineering Fundamentals	Richard Stone and Jeffrey K. Ball	SAE International	1st Edition, 2004
3	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David W. Rosen, and Brent Stucker	Springer	2nd Edition, 2015
4	Heating, Ventilating, and Air Conditioning Analysis and Design	Faye C. McQuiston, Jerald D. Parker, and Jeffrey D. Spitler	John Wiley & Sons	6th Edition, 2005
5	Materials for Civil and Construction Engineering	Mamlouk, M.S.,and Zaniewski, J.P	Pearson Publishers	4th Edition, 2017
6	Materials for Civil and Construction Engineering	Mamlouk, M. S., and Zaniewski, J. P	Pearson Publishers	4th edition 2021
7	Building Construction	Rangwala S.C and Dalal K B	Charotar Publishing house	34th edition 2022
8	Construction Technology Vol. I to IV	Chudley, R	Longman group, England Course Plan	2nd edition 2014
9	Building Construction Volumes 1 to 4	Mckay, W.B. and Mckay, J. K	Pearson India Education Services	4th Edition 2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/112/105/112105123/ https://nptel.ac.in/courses/112/106/112106133/ https://nptel.ac.in/courses/112/105/112105129/
2	https://nptel.ac.in/courses/112/105/112105171/ https://nptel.ac.in/courses/112/105/112105268/ https://archive.nptel.ac.in/courses/112/107/112107145
3	https://archive.nptel.ac.in/courses/105/106/105106201/ https://archive.nptel.ac.in/courses/129/106/129106002/
4	https://archive.nptel.ac.in/courses/105/106/105106206/

SEMESTER S2

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to Group C & D)

Course Code	**GZEST204**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	4:0:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Apply fundamental concepts and circuit laws to solve simple DC/AC electric circuits
2. Develop an awareness on the fundamentals of electric power generation, transmission and distribution
3. Compare different types of DC and AC motors
4. Describe the fundamental concepts of electronic components and devices
5. Outline the basic principles of an electronic instrumentation system
6. Identify important applications of modern electronics in the contemporary world

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Generation of alternating voltages**: - Faradays laws of Electromagnetic induction, Generation of Alternating Voltage, Elementary Generator, Representation of ac voltage and currents, sinusoidal waveforms: frequency, period average, RMS values and form factor of waveform; (Simple numerical problems) **DC Circuits**: Resistance in Series and Parallel, Ohms Law and Kirchhoff's laws, Voltage and current divider rule (Simple numerical problems)	**11**

	AC circuits: Purely resistive, inductive and capacitive circuits; Inductive and capacitive reactance, concept of impedance. (Simple numerical problems) **Three phase AC systems**: Representation of three phase voltages; star and delta connections (balanced only), relation between line and phase voltages, line and phase currents **Power in AC circuits** – Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems)	
2	**Generation of electrical energy:** Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description) **Introduction to non-conventional energy sources**: solar, wind, small hydro plants, PV system for domestic application. **Transformers. Principle of operation, step-up and step-down transformers** **AC power supply scheme:** Single phase and three phase system, Three phase 3 wire and 4 wire systems, Transmission System, Distribution system: Feeder, distributor, service mains **Types of Motors –** Principle of Operation: Block diagram showing power stages, losses and efficiency (electrical and mechanical and overall efficiency); Simple numerical efficiency **Introduction to different types of DC and AC motors.** Classification and different type of dc and ac motors, common applications: Principle of traction and applications **Earthing:** need for earthing, Types of earthing; pipe earthing, plate earthing; **Principle of operation of MCB, ELCB/RCCB**	**11**

3	**Introduction to Semiconductor devices:** Electronic components- Passive and active components - Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, colour coding. PN Junction diode: - Principle of operation, V-I characteristics. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation Digital Electronics: -Binary number system, Boolean algebra and Logic Gates, Universal gates. Basic electronic circuits: - Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: - Transistor as an amplifier, Block diagram of Public Address system	**11**
4	**Electronic Instrumentation:** Quality of measurements -accuracy, precision, sensitivity and resolution, Working principle and applications of Sensors – pressure – strain gauge, Bourden gauge, temperature – RTD, thermocouple, proximity – capacitive sensor, ultrasonic sensor and accelerometer. Internet of things (IoT): Introduction, architecture of IoT, Implementation of smart city – street lighting, smart parking.	**11**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply fundamental concepts and circuit laws to solve simple DC/AC electric circuits	**K2**
CO2	Develop an awareness on the fundamentals of electric power generation, transmission and distribution	**K3**
CO3	Compare different types of DC and AC motors	**K2**
CO4	Describe the fundamental concepts of electronic components and devices	**K2**
CO5	Outline the basic principles of an electronic instrumentation system	**K2**
C06	Identify important applications of modern electronics in the contemporary world	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3		2			2	1					2
CO3	3					1						2
CO4	3	1										2
CO5	3		1									2
CO6	3					2	1					2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Basic Electrical Engineering	D P Kothari and I J Nagrath	Tata McGraw Hill	4/e 2019
2	Schaum's Outline of Basic Electrical Engineering	J.J.Cathey and Syed A Nasar	Tata McGraw Hill	3/e 2010
3	Basic Electronics: Principles and Applications	Chinmoy Saha, Arindham Halder and Debarati Ganguly	Cambridge University Press	1/e 2018
4	Basic Electrical and Electronics Engineering	D. P. Kothari and I. J. Nagrath	McGraw Hill	2/e 2020
5	The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World	Michael Miller	QUE	1/e 2015
6	Basic Electronics and Linear Circuits	N N Bhargava D C Kulshreshtha and S. C. Gupta	McGraw Hill	2/e 2017
7	Electronic Communication Systems	Kennedy and Davis	McGraw Hill	6/e 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2/e 2019
2	Electrical Engineering Fundamentals	Del Toro V	Pearson Education	2/e 2019
3	Basic Electrical Engineering	T. K. Nagsarkar, M. S. Sukhija	Oxford Higher Education	3/e 2017
4	Electronics: A Systems Approach	Neil Storey	Pearson	6e 2017
5	Electronic Devices and Circuit Theory	Robert L. Boylestad and Louis Nashelsky	Pearson	11e 2015
6	Principles of Electronic Communication Systems	Frenzel, L. E	McGraw Hill	4e 2016
7	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill	1/e 2017
8	Electronic Communication	Dennis Roddy and John Coolen	McGraw Hill	4/e 2008
9	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2/e 2019

SEMESTER S2

ENGINEERING ENTREPRENEURSHIP AND IPR
(Common to all Branches)

Course Code	**UCEST206**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	40
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Develop a framework for identifying, curating and validating engineering-based business ideas.
2. Learn essential tools for understanding product-market fit and customer needs.
3. Create a comprehensive business plan for a new venture.
4. Gain foundational knowledge of Intellectual Property Rights (IPR) and their importance for startups.
5. Develop skills for prototyping, stakeholder engagement, and team collaboration.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Ideation, Innovation & Entrepreneurship** • What is Ideation? • Understanding Innovation • Frameworks for Innovation • The Entrepreneurial Mindset • Starting a Business, types formation statutory compliances. • Resources for Aspiring Entrepreneurs	**9**

	Introduction to Intellectual Property Rights (IPR) • Types of IPR: Patents, trademarks, copyrights, trade secrets Strategies for protecting intellectual property based on the type of innovation • Role of IPR in securing funding and competitive advantage **Importance of building a strong team** • Identifying roles • Skill sets • Team dynamics **Identifying Pain Points and problem statement** • Idea Generation Techniques • Developing and Refining Ideas • Develop strategies for bringing your innovation to life	
2	**Problem and solution canvas preparation** • Orientation and canvas introduction • Customer needs assessment • Market segmentation • Value proposition • Competitive analysis • Market entry strategy • Market validation • Regulatory and legal considerations **Customer profiling** • Review of market research • Customer segmentation • Customer profiling • Persona development • Validation and feedback • Prioritisation and selection • Communication and messaging **Competitor analysis** • Identify competitors • Competitor profiling • SWOT analysis	**9**

	• Market positioning • Customer feedback and reviews • Pricing analysis • Differentiation strategy • Benchmarking and improvement	
3	**Business plan preparation** • Business plan framework • Market analysis • Product/ service description • Marketing and sales strategy • Operations plan • Financial projections • Risk management **Prototype development plan preparation** • Prototype requirements analysis • Technical specifications • Development approach • Development timeline • Resource allocation • Testing and quality assurance • Iterative development and feedback loop • Documentation and version control	**9**
4	**Prototype development** **Stakeholder engagement strategies** • Investors • Partners • Customers • Advisors & Mentors	**9**

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Micro Project	Internal Ex-1	Internal Ex-2	Total
5	35	10	10	60

Micro project / Comprehensive Business Plan:

The course will be evaluated based on a comprehensive Business Plan Report submitted and prototype development evaluation at the end of the course. The report should integrate learnings and activities from each module, demonstrating a deep understanding of the concepts and your ability to apply them to a chosen engineering venture.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• Minimum 1 and Maximum 2 Questions from each module. • Total of 6 Questions, each carrying 2 marks **(6x2 =12 marks)**	• 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. • Each question carries 7 marks. **(4x7 = 28 marks)**	40

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Gain foundational knowledge of Innovation and Entrepreneurship, Intellectual Property Rights (IPR) and their importance for startups.	**K2**
CO2	Develop a framework for identifying, curating and validating engineering-based business ideas.	**K3**
CO3	Learn essential tools for understanding product-market fit and customer needs.	**K3**
CO4	Create a comprehensive business plan for a new venture.	**K6**
CO5	Develop skills for prototyping, stakeholder engagement, and team collaboration.	**K4**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3						
CO2	2	2	3	3	3	3	3	3	3			
CO3	2	2	2	2	2	3	3	3	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Engineering Handbook	Richard C. Dorf	CRC Press	2 nd Edn, 2004
2	The Innovator's DNA	Clayton M. Christensen and Jeffrey H. Dyer	Harvard Business Review Press;	Revised edition (June 4, 2019)
3	Start with Why	SIMON SINEK	Portfolio	Reprint edition (December 27, 2011)
4	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley	2010
5	The Engineering Entrepreneur: A Practical Guide to Starting and Running a Successful Engineering Business in India by Saibal Gupta and Ashok Jhunjhunwala	Saibal Gupta and Ashok Jhunjhunwala	Sage Publications	2011
6	Innovation and Entrepreneurship for Engineers by Bharat Bhushan and Seema Bhushan	Bharat Bhushan and Seema Bhushan	CRS Press	2016
7	Indian Patent Law by P. Narayanan	P. Narayanan	Eastern Book Company	2nd edn/ 2020

8	The Law of Copyright and Designs by B.L. Wadehra	B.L. Wadehra	Universal Law	5th edn/2010
9	Intellectual Property Rights (Including IPR in the Digital Age) by Prabuddha Ganguli	Prabuddha Ganguli	Tata McGraw-Hill Education	2001
10	The Startup India Manifesto: A Guide to the Indian Startup Ecosystem by Rashmi Bansal and Deepinder Goyal	Rashmi Bansal and Deepinder Goyal	Westland Publications	2020

SEMESTER S1/S2

HEALTH AND WELLNESS

(Common to all Groups)

Course Code	**UCHWT127**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	1:0:1:0	**ESE Marks**	0
Credits	1	**Exam Hours**	Nil
Prerequisites (if any)	None	**Course Type**	

Course Objectives:

1. To provide essential knowledge on physical activity, health, and wellness.
2. To ensure students understand body systems, exercise principles, nutrition, mental health, and disease management.
3. To educate students on the benefits of yoga, the risks of substance abuse and basic first aid skills.
4. To equip students with the ability to lead healthier lifestyles.
5. To enable students to design effective and personalized exercise programs

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the Human Body. Quantifying Physical Activity Energy Expenditure and Metabolic equivalent of task (MET) Exercise Continuum: Light-intensity physical activity, Moderate - intensity physical activity, Vigorous -intensity physical activity. Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme Components of Health related Physical Fitness: - Cardiorespiratory	4

	Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	
2	Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health. Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	**2**
3	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - Cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes - Osteoporosis - Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis , flat foot, Knock knee) Meaning, Aims and objectives of yoga - Classification and importance of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative - Cocaine - Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	**4**
4	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	**2**

Additional Topics

- Need and Importance of Physical Education and its relevance in interdisciplinary context. Understanding of the Endocrine System
- Developing a fitness profile
- Healthy foods habits for prevention and progression of Lifestyle Diseases. Processed foods and unhealthy eating habits.
- Depression - Anxiety - Stress
- Different ways of carrying an injured person. Usage of Automated external defibrillator

Course Assessment Method
(CIE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Case Study/Micro project/Presentation	Activity evaluation	Total
10	20	20	50

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the different human body systems and describe various types of physical activities along with methods to measure and quantify these activities.	K2
CO2	Explain how to maintain or improve health and wellness through psychological practices, dietary habits, and sports activities.	K2
CO3	Discuss about common hypokinetic disorders and musculoskeletal disorders, and describe the importance of leading a healthy lifestyle through the practice of yoga and abstaining from addictive substances.	K2
CO4	Explain the basics of first aid and describe common sports injuries	K2

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2		3		3	3	2		2
CO2				2		3		2	2			2
CO3						3		3				2
CO4				2		3						2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Foundations of Nutrition	Bhavana Sabarwal	Commonwealth Publishers	1999
2	Anatomy and physiology in health and illness.	Ross and Wilson	Waugh, A., & Grant, A.	2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fit to be Well Essential Concept	Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S.	Jones & Bartlett Learning.	2018
2	Introduction to physical education, fitness, and sport.	Siedentop, D., & Van der Mars, H.	Human kinetics.	2022
3	Substance Use Disorders. Manual for Physicians.	Lal, R., & Ambekar, A. (2005).	National Drug Dependence Treatment Centre, New Delhi	2005
4	The exercise health connection-how to reduce your risk of disease and other illnesses by making exercise your medicine.	Nieman, D. C., & White, J. A	Public Health	1998
5	ACSM's resource manual for guidelines for exercise testing and prescription.	Lippincott Williams & Wilkins.	American College of Sports Medicine.	2012
6	Exercise Physiology: energy, nutrition and human performance.	Katch, F. I., Katch, V. L., & McArdle, W. D.	Lippincott Williams & Wilkins	2010

Continuous Internal Evaluation Marks (CIE): for the Health and wellness course

Students will be evaluated as follows.

Title	Method of Evaluation
Attendance	Students must attend at least 75% of both theory and practical classes. They will receive 10 marks based on their class attendance. Students who do not meet the minimum attendance requirement for a course, as specified in the B. Tech regulations, will not be eligible to proceed to the next criteria.
Assignment / Presentation	Assignments will be given to students to assess their understanding of the subjects taught. Students will be required to make presentations on the subjects taught in class, and their understanding of the subjects will be assessed. Based on the Assignments and Presentations the students will be awarded marks out of 20
Activity Evaluation	The Assignment / Presentation faculty handling the class will use the tests from the Fitness Protocols and Guidelines for ages 18+ to 65 years, as set forth by FIT India. Measurements will be taken for all the tests of the FIT India Fitness Protocol and the evaluation will be based on the benchmark score received for the following tests: 1. V Sit Reach Test 2. Partial Curl Up - 30 seconds 3. Push Ups (Male) and Modified Push Up (Female) 4. Two (2) Km Run/Walk Students who achieve a total benchmark score of 8 across the aforementioned 4 tests will be awarded pass marks for activity evaluation. Students who score better will be awarded a maximum mark of 20.

Activity Evaluation - Special Circumstances	Physically challenged and medically unfit students can opt for an objective test to demonstrate their knowledge of the subjects taught. Based on their performance in the objective test, they will be awarded marks out of 20.
Activity Evaluation - Special Considerations - NCC	Students who enrolled themselves in the NCC during the course period (between the start and end dates of the program) and attended 5 college level parades will be awarded pass marks for activity evaluation. Students who attend more parades will be eligible for a maximum mark of 20 based on their parade attendance.

Tests to evaluated as per Criterion - 2 and Benchmark Scores

V Sit Reach Test

How to Perform:

1. The subject removes their shoes and sits on the floor with the measuring line between their legs and the soles of their feet placed immediately behind the baseline, heels 8-12" apart.

2. The thumbs are clasped so that hands are together, palms facing down and placed on the measuring line.

3. With the legs held flat by a partner, the subject slowly reaches forward as far as possible, keeping the fingers on baseline and feet flexed.

4. After three tries, the student holds the fourth reach for three seconds while that distance is recorded.

5. Make sure there are no jerky movements, and that the fingertips remain level and the legs flat.

Infrastructure/Equipment Required:

1. A tape for marking the ground, marker pen, and ruler.

2. With the tape mark a straight line two feet long on the floor as the baseline, and a

measurement line perpendicular to the midpoint of the baseline extending two feet on each side.

3. Use the marker pen to indicate every centimeter and millimeter along the measurement line. The point where the baseline and the measuring line intersect is the zero point.

Scoring: The score is recorded in centimeters and millimeters as the distance reached by the hand, which is the difference between the zero point (where the baseline and measuring line intersect) and the final position.

Scoring for V Sit Reach Test for Males

Level	Benchmark Score	Measurement (cm)
1	2	<11
2	4	12-13
3	6	14-17
4	7	18-19
5	8	20-21
6	9	22
7	10	>22

Scoring for V Sit Reach Test for Females

Level	Benchmark Score	Measurement (cm)
1	2	<14
2	4	15-16
3	6	17-19
4	7	20-21
5	8	22
6	9	23
7	10	>23

Partial Curl Up - 30 seconds

How to Perform:

1. The subject lies on a cushioned, flat, clean surface with knees flexed, usually at 90 degrees, with hands straight on the sides (palms facing downwards) closer to the ground, parallel to the body.

2. The subject raises the trunk in a smooth motion, keeping the arms in position, curling up the desired amount (at least 6 inches above/along the ground towards the parallel strip).

3. The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor.

Infrastructure/Equipment Required:

Flat clean cushioned surface with two parallel strips (6 inches apart), Stopwatch

Scoring: Record the maximum number of Curl ups in a certain time period 30

seconds.

Scoring for Partial Curl Up - 30 seconds Test for Males

Level	Benchmark Score	Numbers
1	2	<25
2	4	25-30
3	6	31-34
4	7	35-38
5	8	39-43
6	9	44-49
7	10	>49

Scoring for Partial Curl Up - 30 seconds Test for Females

Level	Benchmark Score	Numbers
1	2	**<18**
2	4	18-24
3	6	25-28
4	7	29-32
5	8	33-36
6	9	37-43
7	10	>43

Push Ups for Male/Modified Push Ups for Female How to Perform:

1. A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angle to the body.
2. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended.

3. This action is repeated, and the test continues until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups.

4. For Female: push-up technique is with the knees resting on the ground.

Infrastructure/Equipment Required:

Flat clean cushioned surface/Gym mat

Scoring: Record number of correctly completed pushups.

Scoring for Push Ups for Male

Level	Benchmark Score	Numbers
1	2	<4
2	4	04- 10
3	6	11 -18
4	7	19-34
5	8	35-46
6	9	47-56
7	10	>56

Scoring for Modified Push Ups for Female

Level	Benchmark Score	Numbers
1	2	0-1
2	4	2 - 5
3	6	6 -10
4	7	11 - 20
5	8	21-27
6	9	27-35
7	10	>35

2 Km Run/Walk

How to Perform:

1. Participants are instructed to run or walk 2 kms in the fastest possible pace.

2. The participants begin on signal (Starting point)- "ready, start". As they cross the finish line, elapsed time should be announced to the participants.

3. Walking is permitted but the objective is to cover the distance in the shortest possible time.

Infrastructure/Equipment Required:

Stopwatch, whistle, marker cone, lime powder, measuring tape, 200 or 400 m with 1.22 m (minimum 1 m) width preferably on a flat and even playground with a marking of starting and finish line. You can also use any application on your mobile phone that tells you the distance.

Scoring: Time taken for completion (Run or Walk) in min, sec.

Scoring for 2Km Run/walk for Male

Level	Benchmark Score	Minutes: Seconds
1	2	> 11:50
2	4	10:42
3	6	09:44
4	7	08:59
5	8	08:33
6	9	07:37
7	10	>07:37

Scoring for 2Km Run/walk for Female

Level	Benchmark Score	Minutes: Seconds
1	2	>13:47
2	4	12:51
3	6	12:00
4	7	11:34
5	8	10:42
6	9	09:45
7	10	>09:45

SEMESTER - S1/S2

LIFE SKILLS AND PROFESSIONAL COMMUNICATION
(Common to all Branches)

Course Code	**UCHUT128**	**CIE Marks**	100
Teaching Hours/Week (L: T:P: R)	2:0:1:0	**ESE Marks**	0
Credits	1	**Exam Hours**	-
Prerequisites (if any)	None	**Course Type**	Activity-based learning

Course objectives:

5. To foster self-awareness and personal growth, enhance communication and interpersonal connection skills, promote effective participation in groups and teams, develop critical thinking, problem-solving, and decision-making skills, and cultivate the ability to exercise emotional intelligence.

6. To equip students with the necessary skills to listen, read, write & speak, to comprehend and successfully convey any idea, technical or otherwise.

7. To equip students to build their profile in line with the professional requirements and standards.

Continuous Internal Evaluation Marks (CIE):

- Continuous internal evaluation is based on the individual and group activities as detailed in the activity table given below.
- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. They should use online collaboration tools for group activities, report/presentation making and work management.
- Activities are to be distributed between 3 class hours (2L+1P) and 3.5 Self-study hours.
- Marks given against each activity should be awarded fully if the students successfully complete the activity.
- Students should maintain a portfolio file with all the reports and other textual materials generated from the activities. Students should also keep a journal related to the activities undertaken.
- Portfolio and journal are mandatory requirements for passing the course, in addition to the

minimum marks required.

- The portfolio and journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through the HMC courses and Mini project course.
- Self-reflection questionnaire shall be given at the beginning of the semester, in between and at the end of the semester based on the guidelines in the manual of the course

Table 1: Activity Table

Sl. No.	Activity	Class room (L) / Self Study (SS)	Week of completion	Group / Individual (G/I)	Marks	Skills	CO
1.1	Group formation and self-introduction among the group members	L	1	G	-	• Connecting with group members • Time management - Gantt Chart	
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	1	G	-		
1.3	Preparation of Gantt chart based on the time plan	SS	1	G	2		
2.1	Take an online personality development test, self-reflect and report	SS	1	I	2	• Self-awareness Writing	CO1
2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their ● Strengths, ● Areas for improvement, ● Concerns, ● Areas in which he/she hesitates to take advice, ● Goals/Expectations, from the point of view of the following assumed roles i) their parent/guardian/mentor ii) their friend/sibling/cousin	L	1	I	2	●Goal setting - Identification of skills and setting goal ●Self-awareness ●Discussion in groups ●Group work- Compiling of ideas • Mind mapping	CO1
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about the ● Skills required as a B.Tech graduate ● Attitudes, habits, approaches required and activities to be practised during their B.Tech years, in order to achieve the set goals	SS	1	I	2		CO1

2.4	Discuss the skills identified through rolestorming excercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role-storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	• Empathy	CO2
4.1	Each student connects and networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (atleast 1 through LinkedIn)	SS	3	I	2	• Workplace awareness • Listening • Communication - interacting with people • Networking through various media including LinkedIn • Discussion in groups • Report preparation • Creativity Goal setting - Preparation of action plan	
4.2	Interact with them to understand their workplace details including ● workplace skills required ● their work experience ● activities they have done to enhance their employability during their B.Tech years ● suggestions on the different activities to be done during B.Tech years Prepare a documentation of this	SS	3	I	4		CO2
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	SS	3	G	2		CO2
4.4	Report preparation based on the discussions	SS	4	G	3		CO4
4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L	5	G	4		CO3
4.6	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	SS	5	I	2		CO1
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L	6	G	2		CO3
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	SS	6	I	2		CO4
5.3	Use any online tech forum to gather ideas for solving the problem chosen	SS	6	G	2		CO5
5.4	Arrive at a possible solution using six	L	7	G	3		CO3

	thinking hat exercise						
5.5	Prepare a report based on the problem-solving experience	SS	7	G	2		CO4
6.1	Linkedin profile creation	SS	1	I	2	Profile-building	CO6
6.2	Resume preparation	SS	8	I	2		CO6
6.3	Self-introduction video	SS	8	I	3		CO6
7	Prepare a presentation on instances of demonstration of emotional intelligence	SS	9	I	2	Emotional intelligence	CO2
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	SS	10	G	3	Diversity	CO2, CO5
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	SS	10	I	2	• Interview skills	CO6
10	Take an online listening test, self-reflect and report	SS	11	I	2	Listening skills	CO6
11.1	Activities to improve English vocabulary of students	L	8	I/G	4	• English vocabulary • English language skills • Writing • Presentation • Group work • Self-reflection	CO4
11.2	Activities to help students identify errors in English language usage	L	9	I/G	2		CO4
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L	10	I/G	2		CO4
11.4	Write a self-reflection report on the improvement in English language communication through this course	SS	12	I	2		CO4
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L	11 to 12	G	2		CO4, CO5
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies	SS	12	G	4	• Audio-visual presentations creations with the use of technology tools • Effective use of social media platforms • Profile building	CO2, CO4, CO5
12.2	Upload the video content to podcasting platforms or YouTube	SS	12	G	1		CO5
12.3	Add the link of the podcast in their LinkedIn profile	SS	12	G	1		CO5

Table 2: Lab hour Activities (P): 24 Marks

Sl No	Activity	Marks	Skill	CO
1	Hands-on sessions on day-to-day engineering skills and a self-reflection report on the experience gained: 13. Drilling practice using electric hand drilling machines. 14. Cutting of MS rod and flat using electric hand cutters. 15. Filing, finishing and smoothening using electrically operated hand grinders. 16. MS rod cutting using Hack saw by holding the work in bench wise. 17. Study and handling different types of measuring instruments. 18. Welding of MS, SS work pieces. 19. Pipe bending practice (PVC and GI). 20. Water tap fitting. 21. Water tap rubber seal changing practice. 22. Union and valves connection practice in pipes. 23. Foot valve fitting practice. 24. Water pump seal and bearing changing practice.	**24**	Basic practical engineering skills	**3**
2	Language Lab sessions	**-**	Language Skills	**4**

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Develop the ability to know & understand oneself, show confidence in one's potential & capabilities, set goals and develop plans to accomplish tasks	**K5**
CO2	Develop the ability to communicate and connect with others, participate in groups/teams, empathise, respect diversity, be responsible and understand the need to exercise emotional intelligence	**K5**
CO3	Develop thinking skills, problem-solving and decision-making skills	**K5**
CO4	Develop listening, reading, writing & speaking skills, ability to comprehend & successfully convey any idea, and ability to analyze, interpret & effectively summarize textual, audio & visual content	**K6**
CO5	Develop the ability to create effective presentations through audio-visual mediums with the use of technology tools and initiate effective use of social media platforms & tech forums for content delivery and discussions	**K6**
CO6	Initiate profile-building exercises in line with the professional requirements, and start networking with professionals/academicians	**K6**

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1										1		3
CO2					1			3		3		3
CO3		1	1		1					1		1
CO4					1					1		2
CO5					1	1				1		2
CO6					1					1		

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press	First Edition, 2022
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury, Publishing PLC	25th Anniversary Edition December 2020
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business	September 2023
4	Deep Work: Rules for focused success in a distracted world	Cal Newport	PIATKUS	January 2016
5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
6	Interchange	Jack C. Richards, With Jonathan Hull, Susan Proctor	Cambridge publishers	5th Edition

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Life Skills for Engineers	Remesh S., Vishnu R.G.	Ridhima Publications	First Edition, 2016
2	Soft Skills & Employability Skills	Sabina Pillai and Agna Fernandez	Cambridge University Press	First Edition, 2018
3	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
4	English Grammar in Use	Raymond Murphy,	Cambridge University Press India PVT LTD	5th Edition 2023
5	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey. New York	2004

SEMESTER S2

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

(Common to Group C & D except for Civil Engineering Branch)

Course Code	**GZESL208**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	**0:0:2:0**	**ESE Marks (Internal only)**	50
Credits	**1**	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Lab

Course Objectives:

1. Demonstrate safety measures against electrical shocks
2. Develop familiarity with transformers, rheostats, batteries and earthing schemes
3. Develop the connection diagram and identify the suitable accessories necessary for wiringsimple electric circuits
4. Identify various electronic components
5. Operate various measuring instruments
6. Design simple electronic circuits on breadboard and PCB
7. Build the ability to work in a team with good interpersonal skills.

Expt. No.	Experiments (Minimum of 7 Experiments to be done)
1	a) Demonstrate the precautionary steps adopted in case of Electrical shocks. b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB andMCCB, familiarise the ratings.
2	Wiring of a simple light circuit for light/ fan point (PVC conduit wiring) and a 6A plug socket with individual control.
3	Wiring of light/fan circuit using two-way switches. (Staircase wiring)
4	Wiring of fluorescent lamp and a power plug (16 A) socket with a control switch.
5	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.

6	Familiarization of step up and step-down transformers, (use low voltage transformers) Measurement and representation of voltage and waveform to scale in graph sheet with the help of CRO
7	Familiarization of rheostats, measurement of potential across resistance elements and introducing the concept of relative potential using a DC circuit.
8	a)Identify battery specifications using different types of batteries.(Lead acid, Li Ion,NiCd etc.) b) Familiarize different types of earthing (Pipe, Plate Earthing, Mat Schemes) and ground enhancing materials (GEM).
ELECTRONICS WORKSHOP (Minimum of 7 Experiments to be done)	
1	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol and cost of -Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)
2	Drawing of electronic circuit diagrams using BIS/IEEE symbols and Interpret data sheets of discrete components and IC's
3	Familiarization/Application of testing instruments and commonly used tools. - Multimeter, Function generator, Power supply, CRO, DSO. Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station
4	Testing of electronic components using multimeter - Resistor, Capacitor, Diode, Transistor and JFET.
5	Printed circuit boards (PCB) - Types, Single sided, Double sided, PTH, Processing methods. Design and fabrication of a single sided PCB for a simple circuit.
6	Inter-connection methods and soldering practice. Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions. Soldering practice in connectors and general-purpose PCB, Crimping.
7	Assembling of electronic circuit/system on general purpose PCB, test and show thefunctioning (Any two)- • Fixed voltage power supply with transformer • Rectifier diode

	• Capacitor filter • Zener/IC regulator • Square wave generation using IC 555 timer in IC base.
8	Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
9	Introduction to EDA tools (such as KiCad or XCircuit)

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Total
5	45	50

End Semester Examination Marks (ESE): (Internal evaluation only)

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified Lab record.*

Pass Criteria:

- *A student must score a minimum of 50% overall, combining marks from both Continuous Internal Evaluation (CIE) and End Semester Examination (ESE).*
- ***In addition, the student must secure at least 40% in the End Semester Examination (ESE).***

The ESE shall be conducted internally, with evaluation carried out by a panel of faculty members. This panel must include at least one faculty member who was not involved in the Continuous Internal Evaluation (CIE) of the lab course.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Demonstrate safety measures against electrical shocks	**K2**
CO2	Familiarise with transformers, rheostats, batteries and earthing schemes	**K2**
CO3	Illustrate the connection diagram and identify the suitable accessories necessary for wiring simple electric circuits	**K3**
CO4	Identify various electronic components	**K2**
CO5	Select and Operate various measuring instruments	**K3**
CO6	Apply the design procedure of simple electronic circuits on breadboard and PCB	**K3**
CO7	Build the ability to work in a team with good interpersonal skills	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3						2
CO2	1					2	1					2
CO3	2					1						2
CO4	3					2						3
CO5	3				3	2			2			3
CO6	3		3	1	3	2	1		2			3
CO7									3	2		2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Electrical Design Estimatingand Costing	K B Raina and S K Bhattacharya	New Age International Publishers	2/e 2024
2	Electrical Systems Design	M K Giridharan	I K International Publishing House Pvt. Ltd	3/e 2022
3	Basic Electrical Engineering	D P Kothari and I J Nagrath	Tata McGraw Hill	4/e 2019
4	Basic Electronics and LinearCircuits	NN Bhargava, D C Kulshreshtha and S C Gupta	Mc Graw Hill	2/e 2017

Continuous Assessment with equal weightage for both specialisations (45 Marks)

1. **Preparation and Pre-Lab Work (10 Marks)**

   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understandingof the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding ofthe theoretical background related to the experiments.

2. **Conduct of Experiments (15 Marks)**

   - Procedure and Execution: Adherence to correct procedures, accurate execution ofexperiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, andtroubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (10 Marks)**

   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentationof experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record andmaintaining a well-organized fair record.

4. **Viva Voce (10 Marks)**

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Evaluation Pattern for End Semester Examination with equal weightage in both specializations (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure andunderstanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizingmaterials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to theexperiment.
- Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment orprogramming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality ofprogram output.

4. **Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. **Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted

PROGRAMME CORE 1

SEMESTER S2

BIOPROCESS CALCULATIONS

Course Code	**PCBBT205**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	GDCYT122 - Chemistry for Engineers	**Course Type**	Theory

Course Objectives:

1. Prepare students to analyze chemical and biochemical processes through calculations.
2. Develop a systematic approach in students toward solving problems involved in the design, development, and analysis of process engineering systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Units and Conversions: System of Units and Conversion. Chemical composition: Methods of expressing compositions of mixtures and solutions- mole percent, mass percent, volume percent, molarity, molality, normality, ppm, density and specific gravity, and specific gravity scales. Gas Laws: Ideal gas and Real Gas laws, Ideal gas mixtures, gas constant. Composition of gases on a dry basis and wet basis, Average molecular weight, and gas density. Humidity: Humidity and saturation: various terms associated with humidity and saturation. (A treatment using numerical examples on all the above topics is required)	**11**

2	Fundamentals of material balances and energy balances: Definition of unit operations and unit processes. Law of conservation of mass, types of material balance problems – total and component balances, steady and unsteady state processes, batch and continuous processes. Concept of tie element, the basis for calculations, independent material balance equations, degrees of freedom, and steps for solving material balance problems. (A treatment using numerical examples on all the above topics is required) Fundamentals of energy balances: Law of conservation of energy for non- reactive systems, qualitative study of components of energy balance equations. (A brief introduction would be sufficient as the same will be learned in details in higher semesters)	**11**
3	Material balances without chemical reactions: Material balances for unit operations like evaporation, crystallization, leaching, extraction and distillation. Qualitative and quantitative study of bypass, recycle and purging operations Case study on filtration operations in downstream processing (A treatment using numerical examples on all the above topics is required)	**11**
4	Material balances with chemical reactions: Definition of terms like limiting reactant, excess reactant, percentage yield and selectivity, extent of reaction Combustion of solid, liquid and gaseous fuels (Biological reactions, Carbon and Sulphur compounds only). Orsat analysis. Heat of reaction and application of Hess's law.	**11**

	Stoichiometry of cell growth and product formation – elemental balances, degree of reduction, respiratory quotient, yield factors (YX/S, YP/S) and maximum possible yield, Theoretical oxygen demand based on degree of reduction (A treatment using numerical examples on all the above topics is required)	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Use appropriate system of units for quantities in engineering problem solving	**K2**
CO2	Solve the material balance equations for unit operations and unit processes in bioprocess engineering	**K3**
CO3	Formulate growth medium conditions based on stoichiometry and elemental balances.	**K3**
CO4	Apply energy balance concepts in bioprocessing.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		-	-	-	-	-	1	-	-	1
CO2	2	2	1	-	-	-	-	-	2	-	-	2
CO3	2	2	1	-	-	-	-	-	1	-	-	1
CO4	2	2	1	-	-	-	-	-	1	-	-	1

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Stoichiometry and Process Calculations	K.V. Narayanan, B. Lakshmikutty	Prentice Hall of India Learning (P) Ltd	Second, 2017
2	Bioprocess Engineering Principles	Pauline M Doran	Elsevier- Academic Press	Second, 2013

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Basic Principles and Calculations in Chemical Engineering	David M. Himmelblau, James B. Riggs	Prentice Hallof India Learning (P) Ltd	Ninth, 2021
2	Stoichiometry	B.I. Bhatt, S.M. Vora	Tata McGraw Hill	Fourth, 2010

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/102/106/102106069/
2	https://archive.nptel.ac.in/courses/103/103/103103165/

SEMESTER S2

FOOD CHEMISTRY

Course Code	PCFTT205	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To deliver an understanding of the chemical function and properties of major biomolecules as food components.
2. To understand the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Food chemistry: Importance of food, Scope of food chemistry. Different food groups: their classification and importance. Water - Structure of water molecule, properties of water, water activity and its importance, determination of water quality for food processing. Vitamins- Definition, Classification, general sources, functions and dietary requirements, deficiency symptoms of vitamins. Basal metabolic rate, Calorific value of food, balanced diet- Computing caloric requirements	11

2	Chemistry of carbohydrates –Definition, classification, Structure of major mono-, di- and polysaccharides. Properties and reactions of carbohydrates. Browning reactions- Caramelization, Maillard reaction, Dextrose Equivalent. Sugar alcohols – properties. Glycemic Index – definition and significance. Starch- properties, thickening & gelatinization, modified starches, resistant starch, Dextrin sand dextrans, Starch hydrolysis. Pectins, gums & seaweeds- Food sources, functional role in foods.	**11**
3	Proteins- Definition, Classification -according to composition, structure, and functions. Role of proteins in food and dietary requirements Amino acids-Definition, classification, Physical and chemical properties of proteins, Important protein sources– Milk, Meat, Fish, Egg and Cereal proteins – Texturized proteins Food Enzymes- Food sources, functional role and uses in foods. Biological value of protein- Protein Malnutrition- Obesity	**11**
4	Lipids- Definition, structure, classification & nomenclature. Properties of fats & oils: crystal formation, polymorphism, melting points, plasticity and isomerisation. Modification of fats: hydrogenation- cis and trans isomers, inter-esterification. Rancidity and its types; Shortening power of fats, tenderization, emulsification. Food sources of lipids, functional role and uses in foods.	**11**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamentals of bio molecules and describe the food sources	**K2**
CO2	Explain the principal components of food, their chemical and nutritional properties	**K2**
CO3	Understand the relationship between the composition of the individual food components and their chemical and physical properties	**K2**
CO4	Recognize real examples underlying physicochemical mechanisms responsible for food functionality and be able to use their knowledge of food chemistry	**K2**
CO5	Understand the quality changes in food components during processing and preservation	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3											
CO2	3											2
CO3	2	2	2	3								2
CO4	2	2	2	2								
CO5	2	2										2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Food Chemistry	Chopra, H.K. and P.S. Panesar.	Narosa	2010
2	Food Chemistry	H.-D. Belitz , W. Grosch , P. Schieberle	Springer	2004 (3Ed.)
3	Biochemistry	U. Satyanarayana, U. Chkrapani	Elsevier	2017(5Ed.)
4	Food Chemistry	Hans-Dieter Belitz , Werner Grosch , Peter Schieberle	Springer	2009(4Ed.)

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Handbook of Food Chemistry	Peter Chi Keung Cheung, Bhavbhuti M. Mehta,	Springer Berlin Heidelberg	2015(1Ed.)
2	Principles of Food Chemistry (Food Science Text Series)	John M. deMan, John W. Finley, W. Jeffrey Hurst, Chang Yong Lee,	Springer	2018 (4Ed.)
3	Food Biochemistry and Nutritional Value	Robinson, D. S	Longman Scientific and Technical, London	1987
4	Principles of Food Chemistry	John M. deMan, John W.Finley, W.Jeffrey Hurst, Chang Yong Lee	Springer	2018(3Ed.)

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.swayam2.ac.in/cec20_ag10/preview
2	https://onlinecourses.swayam2.ac.in/cec20_ag10/preview
3	https://onlinecourses.swayam2.ac.in/cec20_ag10/preview
4	https://onlinecourses.swayam2.ac.in/cec20_ag10/preview