APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

(A State Government University)

B. Tech- 2024

FIRST YEAR SYLLABUS
(GROUP B)

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SEMESTER 1
GROUP B

SEMESTER S1

MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE - 1

(Common to Groups B & C)

Course Code	**GYMAT101**	**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 single variable calculus and matrix operations.	**Course Type**	Theory

Course Objectives:

1. To provide a comprehensive understanding and basic techniques of matrix theory to analyze linear systems.
2. To offer advanced knowledge and practical skills in solving second-order ordinary differential equations, applying Laplace transforms, and understanding Fourier series, enabling students to analyze and model dynamic systems encountered in engineering disciplines effectively.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Linear systems of equations: Gauss elimination, Row echelon form, Linear Independence: rank of a matrix, Solutions of linear systems: Existence, Uniqueness (without proof), The matrix Eigen Value Problem, Determining Eigen values and Eigen vector, Diagonalization of matrices. **(Text 1: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.4)**	**9**

2	Homogeneous linear ODEs of second order, Superposition principle, General solution, 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, $kcos\omega x$, $ksin\omega x$, $ke^{\alpha x}cos\omega x$, $ke^{\alpha x}sin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE(with constant coefficients), Solution by variation of parameters (Second Order). **(Text 1: Relevant topics from sections 2.1, 2.2, 2.7, 2.10)**	**9**
3	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), Unit step function, Second shifting theorem, Dirac delta function and its transform (Initial value problems involving unit step function and Dirac delta function are excluded), Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions. **(Text 1: Relevant topics from sections 6.1, 6.2, 6.3, 6.4, 6.5)**	**9**
4	Taylor series representation (without proof, assuming the possibility of power series expansion in appropriate domains), Maclaurin series representation, Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions), Fourier series of 2π periodic functions, Fourier series of $2l$ periodic functions, Half range sine series expansion, Half range cosine series expansion. **(Text 1: Relevant topics from sections 11.1, 11.2, Text 2: Relevant topics from section 10.8)**	**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 systems of linear equations and diagonalize matrices.	**K3**
CO2	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients.	**K3**
CO3	Compute Laplace transform and apply it to solve ODEs arising in engineering.	**K3**
CO4	Determine the Taylor series and evaluate Fourier series expansion for different periodic functions.	**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	Calculus	H.Anton,I.Biven,S.Davis	Wiley	12th edition, 2024

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	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis	9th edition, 2021
5	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023
6	Calculus	H. Anton, I. Biven, S.Davis	Wiley	12th edition, 2024
7	Signals and Systems	Simon Haykin, Barry Van Veen	Wiley	2nd edition, 2002

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/111/104/111104031/
3	https://archive.nptel.ac.in/courses/111/106/111106139/
4	https://archive.nptel.ac.in/courses/111/101/111101164/

SEMESTER S1/S2

PHYSICS FOR ELECTRICAL SCIENCE
(Common to Group B)

Course Code	**GBPHT121**	**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 to impart this knowledge in Electrical 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	**Semiconductor Physics** Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band, Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative) Formation of p-n junction, Fermi level in semiconductors-intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction - Forward and reverse biased p-n junctions, Diode equation (Derivation), V-I Characteristics of p-n junction	**9**

2	**Semiconductor Devices** Semiconductor devices - Rectifiers- Full wave and Half wave, Zener diode - V-I characteristics - Zener breakdown and Avalanche breakdown, Tunnel diode - V-I characteristics, Applications of Zener and Tunnel diodes. Photonic devices (qualitative) - Photo detectors (Junction and PIN photodiodes), Applications, Solar cells- V-I Characteristics, Efficiency, Stringing of Solar cells to solar panel, Light Emitting Diode, Applications of LED	**9**
3	**Superconductivity & Dielectrics** Super conductivity, Transition temperature, Critical field, Meissner effect, Type I and Type II Super conductors, Applications of superconductors. Dielectric constant, Polarization, Permittivity- relative permittivity, Relation between polarization and dielectric constant, Types of Polarization, Internal fields in liquids and solids, Clausius Mossotti Relation, Dielectric loss(qualitative), Dielectric breakdown (qualitative)	**9**
4	**Laser & Fiber Optics** Optical processes - Absorption, Spontaneous emission and stimulated emission, Properties of laser, 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, Semiconductor Laser (Qualitative), Applications of laser. Optical fiber-Principle of propagation of light, Types of fibers-Step index and Graded index fibers, Numerical aperture –Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	**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	Explain the fundamentals of Semiconductor Physics.	**K2**
CO2	Describe the behaviour of semiconductor materials in semiconductor devices.	**K2**
CO3	Explain Superconductivity and basic theory of dielectrics	**K2**
CO4	Apply the comprehended knowledge about laser and fibre optics in various engineering applications	**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	2										3
CO5	3	2			3				2			3

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Edition, 2003
2	Engineering Physics	H K Malik and A K Singh	McGraw Hill	2nd Edition, 2017
3	A Textbook of Engineering Physics	MN Avadhanulu, P G Kshirsagar, TVS Arun murthy	S. Chand	11th Edition, 2018

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education	1995
2	Advanced Semiconductor Fundamental	Robert F Pierret	Pearson Education	2nd Edition, 2002
3	Solid State Electronic Devices	Ben G Streetman and Sanjay Kumar Banerjee	Pearson Education 6/e	2010
4	Solid State Physics	S.O. Pillai	New age international publishers	10th Edition, 2022
5	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition	2019
6	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition ,2017
7	A Text Book of Engineering Physics	I. Dominic and. A. Nahari,	Owl Books Publishers	Revised Edition, 2016

Video Links (NPTEL, SWAYAM etc)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/108106181
2	https://nptel.ac.in/courses/108108112
3	https://nptel.ac.in/courses/115103108
4	https://nptel.ac.in/courses/115102124

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
(Minimum 10 Experiments)

Experiment No.	Experiment
1	Diode characteristics
2	Zener diode- V-I characteristics
3	Tunnel diode –V-I characteristics
4	Half wave rectifier
5	Full wave rectifier
6	Hall effect in semiconductors
7	Determination of band gap energy of a semiconductor
8	Characteristics of LED
9	Solar Cell- V-I and Intensity Characteristics

10	Laser – Determination of wavelength using diffraction grating
11	Laser- To measure the wavelength using a millimetre scale as a grating
12	Compare the variation of current with potential difference, for a metal, filament bulb and semiconductor diode.
13	Determination of dielectric constant
14	CRO -Measurement of frequency and amplitude of wave forms
15	Photo diode- V-I Characteristics
16	Numerical aperture of optical fiber

SEMESTER S1/S2

CHEMISTRY FOR INFORMATION SCIENCE & ELECTRICAL SCIENCE

(GROUPS A & B)

Course Code	**GXCYT122**	**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 comprehensive understanding of chemistry concepts that are relevant to engineering applications.
2. To familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. To raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on the quality of life.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**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** –Electrochemical corrosion mechanism (acidic & alkaline medium) - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection – Electroplating of copper - Electroless plating of copper.	9

2	**Materials for Electronic Applications** **Nanomaterials** - Classification based on Dimension & Materials-Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials – Carbon Nanotubes, Fullerenes, Graphene & Carbon Quantum Dots – structure, properties & application. **Polymers** - Fire Retardant Polymers- Halogenated & Non-halogenated polymers (Examples only)- Conducting Polymers-Classification-Polyaniline & Polypyrrole-synthesis, properties and applications. **Organic electronic materials and devices**- construction, working and applications of Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC) Materials used in Quantum computing Technology, Super capacitors, Spintronics	**9**
3	**Molecular Spectroscopy and Analytical Techniques** **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 **Thermal Analysis**: Dielectric Thermal Analysis (DETA) of Polymers-Working and Application. **Electron Microscopic Techniques:** SEM - Principle, instrumentation and Applications.	**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), BOD and COD- Definition & Significance.	**9**

	Waste Management: Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. E Waste, Methods of disposal – recycle, recovery and reuse. Chemistry of climate change- Greenhouse Gases- Ozone Depletion-Sustainable Development- an introduction to Sustainable Development Goals.	

Self-Study Topics (NOT TO BE INCLUDED FOR END SEMESTER EXAMINATION): Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery.

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	Explain the Basic Concepts of Electrochemistry and Corrosion to explore the possible applications in various engineering fields	**K2**
CO2	Describe the use of various engineering materials in different industries	**K2**
CO3	Apply appropriate analytical techniques for the synthesis and characterization of various 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 S1

ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING

(Common to 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)

Student can choose any one full question out of two questions from each module

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

INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to Group A & B)

Course Code	**GXEST104**	**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**	Group Core-Theory

Course Objectives:

1. To provide an understanding of the fundamental principles of electrical engineering
2. To introduce the working principles of fundamental electronic devices and circuits
3. To provide an overview of the basic concepts in different types of communication.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Elementary concepts of DC electric circuits:** Current and Voltage Division Rule - Relative potential Capacitors & Inductors: V-I relations and Energy stored. Ohms Law and Kirchhoff's laws - numerical problems. Star-delta conversion *(resistive networks only - derivation not required)* - numerical problems. **Analysis of DC Electric circuits:** Mesh current method – matrix representation - Solution of network equations.	**11**

	Node voltage methods-matrix representation-solution of network equations by matrix methods - numerical problems. **Elementary Concepts of Magnetic circuits:** Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - Comparison between electric and magnetic circuits - Series and parallel magnetic circuits with composite materials (*numerical problems not needed*)	
2	**Electromagnetic Induction**: Faraday's laws, Lenz's law- statically induced and dynamically induced emf – Self-inductance and mutual inductance, coefficient of coupling *(numerical problems not needed)* **Alternating Current fundamentals:** Generation of alternating voltages - Representation of sinusoidal waveforms: frequency, period, average value, RMS value and form factor - numerical problems AC Circuits: Phasor representation of sinusoidal quantities, Trigonometric, Rectangular, Polar and complex forms. **Analysis of simple AC circuits:** Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance - numerical problems. RL, RC and RLC series circuits- power factor, active, reactive and apparent power. Simple numerical problems. Three phase AC systems: Generation of three phase voltages, advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- numerical problems	**11**
3	**Introduction to Electronic devices:** Passive and active components in electronics Working of PN junction diode, V-I characteristics of PN Junction diode Zener diode and avalanche breakdown. Basics of Zener voltage regulator	**13**

	Block diagram of DC power supply, circuit and working of half wave, full wave and bridge rectifiers, ripple factor (with and without capacitor filters) Construction, working and V-I Characteristics of BJT, Input output characteristics of CE configuration, Comparison of CE, CB and CC configurations Concept of biasing and load line Transistor as a switch, Transistor as an amplifier (Circuit Diagram and working) RC coupled amplifier - Circuit diagram and frequency response Introduction to FET, Construction and working of N-channel and P-Channel MOSFETs	
4	**Modern Electronics and its applications:** General block diagram of a Communication system, Block diagram of Fiber optic Communication system Concept of AM and FM (No derivation required), Block diagram of AM and FM super-heterodyne receiver Basic concepts of Wired and Wireless communication, Block diagram of GSM Comparison of 3G, 4G, 5G and 6G communication technologies Block diagrams of Electronic instrumentation system, Digital Multimeter, Function generator Introduction to CRO and Lissajous patterns Applications of modern electronics – IoT based smart homes, healthcare and agriculture *(Case study 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	Apply fundamental concepts and circuit laws to solve simple DC/AC electric circuits	**K2**
CO2	Classify series and parallel magnetic circuits	**K2**
CO3	Understand three phase AC systems	**K2**
CO4	Describe the fundamental concepts of electronic components and devices	**K2**
CO5	Outline the principles of communication systems	**K2**
CO6	Identify various 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	2											2
CO3	3	2										2
CO4	2	1										2
CO5	2											2
CO6	3		1			3	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	MGH	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	Pearson	4/e 2008

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	**10**

	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***.	
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 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	**10**

	- 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

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

(Common to All Groups except for Civil Engineering Branch)

Course Code	**GXESL106**	**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 create awareness and familiarity with electrical wiring and safety measures to be taken.
2. To Identify various electronic components and to operate various measuring instruments
3. Learn to setup simple electronic circuits on breadboard and PCB

Expt. No.	**Experiments**
	Electrical Workshop (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 and MCCB, familiarize 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	Familiarisation 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	Familiarisation 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, Processingmethods. 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 the functioning (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 Timelycompletion 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	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 Estimating and Costing	K B Raina and S KBhattacharya	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 Linear Circuits	NN Bhargava, D C Kulshreshtha and S C Gupta	Mc Graw Hill	2/e 2017

Continuous Assessment with equal weightage for both specializations (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.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, andtroubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

2. 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 and maintaining a well-organized fair record.

3. 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 and understandingeach 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 programmingtask.

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

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 Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	**4**

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 - 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				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

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,	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

	from the point of view of the following assumed roles 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 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	
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	SS	3	I	4		CO2

	Prepare a documentation of this					action plan	
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 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	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 mispelled 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 B

SEMESTER S2

MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE - 2

(Common to Group B & C)

Course Code	**GYMAT201**	**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 single variable calculus.	**Course Type**	Theory

Course Objectives:

1. To provide a comprehensive understanding of partial derivatives, multiple integrals, and the differentiation and integration of vector-valued functions, emphasizing their applications in engineering contexts.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	Limits and continuity, Partial derivatives, Partial derivatives of functions with two variables, Partial derivatives viewed as rate of change and slopes, Partial derivatives of functions with more than two variables, Higher order partial derivatives, Local Linear approximations, Chain rule, Implicit differentiation, Maxima and minima of functions of two variables - relative maxima and minima **(Text 1: Relevant topics from sections 13.2, 13.3, 13.4, 13.5, 13.8)**	**9**

2	Double integrals, Reversing the order of integration in double integrals, change of coordinates in double integrals (Cartesian to polar), Evaluating areas using Double integrals, Finding volumes using double integration, Triple integrals, Volume calculated as triple integral, Triple integral in Cartesian and cylindrical coordinates. **(Text 1: Relevant topics from section 14.1, 14.2, 14.3, 14.5, 14.6)**	**9**
3	Vector valued function of single variable - derivative of vector valued function, Concept of scalar and vector fields, Gradient and its properties, Directional derivative, Divergent and curl, Line integrals of vector fields, Work done as line integral, Conservative vector field, independence of path, Potential function (results without proof). **(Text 1: Relevant topics from section 12.1, 12.2, 13.6, 15.1, 15.2, 15.3)**	**9**
4	Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals, finding areas using Greens theorem, Surface integrals over surfaces of the form $z = g(x, y)$, Flux integrals over surfaces of the form $z = g(x, y)$, Divergence theorem (without proof), Using Divergence theorem to find flux, Stokes theorem (without proof) **(Text 1: Relevant topics from section 15.4, 15.5, 15.6, 15.7,15.8)**	**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	Compute the partial and total derivatives and maxima and minima of multivariable functions and to apply in engineering problems.	**K3**
CO2	Understand theoretical idea of multiple integrals and to apply them to find areas and volumes of geometrical shapes.	**K3**
CO3	Compute the derivatives and line integrals of vector functions and to learn their applications.	**K3**
CO4	Apply the concepts of surface and volume integrals and to learn their inter-relations and applications.	**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	Calculus	H. Anton, I. Biven, S.Davis	Wiley	12th edition, 2024

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	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016
4	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis	9th edition, 2021
5	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/111107108
2	https://nptel.ac.in/courses/111107108
3	https://nptel.ac.in/courses/111107108
4	https://nptel.ac.in/courses/111107108

SEMESTER S1/S2

PHYSICS FOR ELECTRICAL SCIENCE

(Common to Group B)

Course Code	**GBPHT121**	**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 to impart this knowledge in Electrical 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	**Semiconductor Physics** Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band, Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative) Formation of p-n junction, Fermi level in semiconductors-intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction - Forward and reverse biased p-n junctions, Diode equation (Derivation), V-I Characteristics of p-n junction	9
2	**Semiconductor Devices** Semiconductor devices - Rectifiers- Full wave and Half wave, Zener	9

	diode - V-I characteristics - Zener breakdown and Avalanche breakdown, Tunnel diode - V-I characteristics, Applications of Zener and Tunnel diodes. Photonic devices (qualitative) - Photo detectors (Junction and PIN photodiodes), Applications, Solar cells- V-I Characteristics, Efficiency, Stringing of Solar cells to solar panel, Light Emitting Diode, Applications of LED	
3	**Superconductivity & Dielectrics** Super conductivity, Transition temperature, Critical field, Meissner effect, Type I and Type II Super conductors, Applications of superconductors. Dielectric constant, Polarization, Permittivity- relative permittivity, Relation between polarization and dielectric constant, Types of Polarization, Internal fields in liquids and solids, Clausius Mossotti Relation, Dielectric loss(qualitative), Dielectric breakdown (qualitative)	**9**
4	**Laser & Fiber Optics** Optical processes - Absorption, Spontaneous emission and stimulated emission, Properties of laser, 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, Semiconductor Laser (Qualitative), Applications of laser. Optical fiber-Principle of propagation of light, Types of fibers-Step index and Graded index fibers, Numerical aperture –Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	**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	Explain the fundamentals of Semiconductor Physics.	**K2**
CO2	Describe the behaviour of semiconductor materials in semiconductor devices.	**K2**
CO3	Explain Superconductivity and basic theory of dielectrics	**K2**
CO4	Apply the comprehended knowledge about laser and fiber optics in various engineering applications	**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	2										3
CO5	3	2			3				2			3

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Edition, 2003
2	Engineering Physics	H K Malik and A K Singh	McGraw Hill	2nd Edition, 2017
3	A Textbook of Engineering Physics	MN Avadhanulu, P G Kshirsagar, TVS Arun murthy	S. Chand	11th Edition, 2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education	1995
2	Advanced Semiconductor Fundamental	Robert F Pierret	Pearson Education	2nd Edition, 2002
3	Solid State Electronic Devices	Ben G Streetman and Sanjay Kumar Banerjee	Pearson Education 6/e	2010
4	Solid State Physics	S.O. Pillai	New age international publishers	10th Edition, 2022
5	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition	2019
6	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition ,2017
7	A Text Book of Engineering Physics	I. Dominic and. A. Nahari,	Owl Books Publishers	Revised Edition, 2016

Video Links (NPTEL, SWAYAM etc)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/108106181
2	https://nptel.ac.in/courses/108108112
3	https://nptel.ac.in/courses/115103108
4	https://nptel.ac.in/courses/115102124

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

(Minimum 10 Experiments)

Experiment No.	Experiment
1	Diode characteristics
2	Zener diode- V-I characteristics
3	Tunnel diode –V-I characteristics
4	Half wave rectifier
5	Full wave rectifier
6	Hall effect in semiconductors
7	Determination of band gap energy of a semiconductor
8	Characteristics of LED
9	Solar Cell- V-I and Intensity Characteristics
10	Laser – Determination of wavelength using diffraction grating
11	Laser- To measure the wavelength using a millimetre scale as a grating
12	Compare the variation of current with potential difference, for a metal, filament bulb and semiconductor diode.
13	Determination of dielectric constant
14	CRO -Measurement of frequency and amplitude of wave forms
15	Photo diode- V-I Characteristics
16	Numerical aperture of optical fiber

SEMESTER S1/S2

CHEMISTRY FOR INFORMATION SCIENCE AND ELECTRICAL SCIENCE

(Common to Group A & B)

Course Code	**GXCYT122**	**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 comprehensive understanding of chemistry concepts that are relevant to engineering applications.
2. To familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. To raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on the quality of life.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Electrochemistry and Corrosion Science (9 Hours)** **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** –Electrochemical corrosion mechanism (acidic & alkaline medium) - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection – Electroplating of copper - Electroless plating of copper.	9

2	**Materials for Electronic Applications (9 Hrs)** **Nanomaterials** - Classification based on Dimension & Materials- Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials – Carbon Nanotubes, Fullerenes, Graphene & Carbon Quantum Dots – structure, properties & application. **Polymers** - Fire Retardant Polymers- Halogenated & Non-halogenated polymers (Examples only)- Conducting Polymers-Classification- Polyaniline & Polypyrrole-synthesis, properties and applications. **Organic electronic materials and devices**- construction, working and applications of Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC) Materials used in Quantum computing Technology**,** Super capacitors, Spintronics	9
3	**Molecular Spectroscopy and Analytical Techniques (9 Hours)** **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 **Thermal Analysis**: Dielectric Thermal Analysis (DETA) of Polymers- Working and Application. **Electron Microscopic Techniques:** SEM - Principle, instrumentation and Applications.	9
4	**Environmental Chemistry (9Hrs)** **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), BOD and COD- Definition & Significance.	9

	Waste Management: Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. E Waste, Methods of disposal – recycle, recovery and reuse. Chemistry of climate change- Greenhouse Gases- Ozone Depletion-Sustainable Development- an introduction to Sustainable Development Goals.	

Self Study Topics (NOT TO BE INCLUDED FOR END SEMESTER EXAMINATION): Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery.

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	Explain the Basic Concepts of Electrochemistry and Corrosion to explore the possible applications in various engineering fields	**K2**
CO2	Describe the use of various engineering materials in different industries	**K2**
CO3	Apply appropriate analytical techniques for the synthesis and characterization of various 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

FOUNDATIONS OF COMPUTING: FROM HARDWARE ESSENTIALS TO WEB DESIGN

(Common to Group A & B)

Course Code	**GXEST203**	**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. To introduce the students to the fundamental building blocks of an IT infrastructure including the computing systems, its peripherals, Operating Systems and Networking.
2. To make the learners capable of developing and deploying simple and dynamic websites.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Computer Hardware – CPU, Memory - Memory hierarchy: registers, cache, RAM, virtual memory, Motherboard - Computer Peripherals - I/O devices, Storage devices- HDDs, SSDs, optical drives, I/O communication and device management, Interface cards – Buses – Firmware - Boot process	9
2	Binary representation of data and numbers, Integer Representation, Data storage units - bits, bytes, kilobytes, etc., ASCII and Unicode, CPU Architecture and Instruction Set: Basic CPU architecture - ALU, registers, control unit, Instruction format and assembly language (basics only) Fetch-execute cycle and instruction execution.	9

3	Computer System Software - Operating Systems, Basic commands in Linux / Windows, Shell scripting (bash). Computer Communications – LAN, MAN, WAN, Client/Server networks, Peer-to-Peer networks, Topologies. Basics of IP addresses, DHCP, NAT, Network Security (Desktop & Perimeter), DNS, VPN, Routers, Client-Server, Internet, WWW, Web servers.	**9**
4	Web Design (Basics of HTML, CSS, and JavaScript) – Understanding the web content delivery, Understanding HTML and XHTML Connections, Understanding Cascading Style Sheets, Understanding JavaScript	**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	Identify the fundamental components and the working of an IT environment.	**K2**
CO2	Explain the data representations, CPU architectures, and the basic functioning of a computer.	**K2**
CO3	Explain the operating systems, computer network architecture, and necessary protocols used.	**K2**
CO4	Develop simple interactive web pages and validate the inputs.	**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										3
CO2	3	3										3
CO3	3	3										3
CO4	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	Invitation to Computer Science	G.Michael Schneider, Judith Gersting	Cengage	Ed 2, 2020
2	The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach	Irv Englander	Wiley	Ed 5, 2014
3	HTML, CSS, and JavaScript All in One, Sams Teach Yourself	Julie C. Meloni Jennifer Kyrnin	Pearson	Ed 1, 2020

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Elements of Computing Systems, second edition: Building a Modern Computer from First Principles	Noam Nisan and Shimon Schocken	The MIT Press	2nd Edn, 2021
2	Peter Norton's Introduction to Computers	Peter Notron	McGrawHill	6th Edn, 2010
3	Web Design with HTML, CSS, JavaScript and Jquery	Jon Duckett	Wiley	First Ed., 2014

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://www.nand2tetris.org/
2	https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

SEMESTER S2

ENGINEERING MECHANICS

(Common to EEE, CP, BR, RA & RU)

Course Code	**GBEST213**	**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. To enable students to analyze basic mechanics problems and apply a vector-based approach to solve them.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to statics:** Introduction to branches of mechanics, concept of rigid body scalars and vectors, vector operations, forces in space. Support reactions of beams (point load and UDL on Simply supported and cantilever beams) **Force systems:** Rectangular components in 2D and 3D, moment and couple, resultants Equilibrium: system isolation and the free-body diagram, equilibrium conditions 2D and 3D	**10**
2	**Friction:** -Laws of friction – analysis of blocks and ladder Centroid of composite areas- – moment of inertia- parallel axis and perpendicular axis theorems. Polar moment of inertia, radius of gyration, mass moment of inertia-ring and disc	**10**

3	**Dynamics** – Rectilinear translation - equations of motion in kinematics and kinetics – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Combined motion of translation and rotation.	**8**
4	**Mechanical vibration** - Free and forced vibration, degree of freedom. Simple harmonic motion - spring mass model,period, stiffness, frequency, simple numerical problems of single degree of freedom	**8**

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 vector representation of forces and moments	**K2**
CO2	Identify and describe the components of system of forces acting on the rigid body	**K3**
CO3	Apply the conditions of equilibrium to different force system.	**K3**
CO4	Identify appropriate principles to solve problems of mechanics.	**K3**
CO5	Develop the understanding of fundamental principles of rigid body dynamics	**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										
CO5	3	3										

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Mechanics	Timoshenko and Young	McGraw Hill Publishers	5th Edition 2017
2	Engineering Mechanics: Combined Statics and Dynamics	Russell C. Hibbeler	Pearson Education	14th Edition 2015
3	Engineering Mechanics - Statics and Dynamics	Shames, I. H.	Prentice Hall of India	4th Edition 2008

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Mechanics Statics	J. L. Meriam, L. G. Kraige	Wiley	*9th Edition 2020*
2	Engineering Mechanics	Chandramouli	PHI Learning	*2011*

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/112106286
2	https://nptel.ac.in/courses/112106286
3	https://nptel.ac.in/courses/112106286
4	https://nptel.ac.in/courses/112106286

SEMESTER S2

PROGRAMMING IN C

(Common to Group A & B)

Course Code	**GXEST204**	**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 prepare learner to write versatile C programs for solving computational problems that they come across in their professional life.
2. To equip the learner to write efficient C programs using suitable language constructs to solve real world computational problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**C Fundamentals** - Character Set, Constants, Identifiers, Keywords, Basic Data types, Variables, Operators and its precedence, Bit-wise operators, Expressions; Statements - Input and Output statements; Structure of a C program; Simple programs. **Control Statements** - if, if-else, nested if, switch, while, do-while, for, break & continue, nested loops.	9
2	**Arrays** - Single dimensional arrays, Defining an array, Array initialization, Accessing array elements; Enumerated data type; Type Definition; Two-dimensional arrays – Defining a two-dimensional array; Programs for matrix processing; Programs for sequential search; Bubble sort; **Strings** - Declaring a string variable, Reading and displaying strings, String	9

	related library functions – Programs for string matching.	
3	**Functions** - Function definition, Function call, Function prototype, Parameter passing; Recursion; Passing array to function; Macros - Defining and calling macros; Command line Arguments. **Structures** - Defining a Structure variable, Accessing members, Array of structures, Passing structure to function; Union. **Storage Class** - Storage Classes associated with variables: automatic, static, external and register.	**9**
4	**Pointers** - Declaration, Operations on pointers, Passing pointer to a function, Accessing array elements using pointers, Processing strings using pointers, Pointer to pointer, Array of pointers, Pointer to function, Pointer to structure, Dynamic Memory Allocation. **Files**- Different types of files in C, Opening & Closing a file, Writing to and Reading from a file, Processing files, Library functions related to file – fseek(), ftell(), fread(), fwrite().	**9**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Continuous Assessment (Lab)	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	Infer a computational problem and develop C programs from them using basic constructs of C language including the control statements.	**K2**
CO2	Develop C programs using arrays, matrices, and strings.	**K3**
CO3	Utilize functions to find solution to the computational problems by dividing it into a number of modules and abstract data types.	**K3**
CO4	Develop C programs using pointers for dynamic data handling.	**K3**
CO5	Use files in C to permanently store and manipulate data.	**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	3	3	-	1	-	1	-	-	-	1
CO2	3	3	3	3	-	1	-	1	-	-	-	1
CO3	3	3	3	3	-	1	-	1	-	-	-	1
CO4	3	3	3	3	-	1	-	1	-	-	-	1
CO5	3	3	3	3	-	1	-	1	-	-	-	1

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Programming with C	Byron S Gottfried	Mc Graw Hill Education	4th Edition July 2018
2	The C Programming Language	Brian W. Kernighan and Dennis Ritchie	Pearson	2nd Edition January 2015
3	C The Complete Reference	Herbert Schildt	Mc Graw Hill Education	4th Edition July 2017

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Programming In Ansi C	E Balagurusamy	Mc Graw Hill	8th Edition March 2019
2	Programming in C	Kamthane	Pearson	3rd Edition January 2015
3	Let us C	Yashavant Kanetkar	Bpb publishers	19th Edition December 2022
4	Computer Programming in C	V Rajaraman	PHI Learning Private Limited	2nd July 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	**9**

	• SWOT analysis • 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 **(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	2nd 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	Saibal Gupta and Ashok Jhunjhunwala	Sage Publications	2011
6	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press	2016
7	Indian Patent Law	P. Narayanan	Eastern Book Company	2nd edn/ 2020
8	The Law of Copyright and Designs	B.L. Wadehra	Universal Law	5th edn/2010
9	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education	2001
10	The Startup India Manifesto: A Guide to the Indian Startup Ecosystem	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 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 for 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 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:						CO1

	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		
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	SS	3	G	2		CO2

	Prepare the Minutes of the discussions						
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	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	SS	11	I	2	Listening skills	CO6

	and report						
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 mispelled 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 prfouactice. 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, empathies, 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

IT WORKSHOP

(Common to Group A&B)

Course Code	**GXESL208**	**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 provide a basic understanding about computer hardware, software, and computer network.
2. To familiarize the learner with the web development process using HTML, CSS, and Javascript.

Details of Experiments

Expt. No	Experiment (Minimum 10 Experiments)
1	Practice Computer Hardware – Familiarization CPU Box, Motherboard, CPU & Chip-set, Interface cards, Card slots, Hard disk, Cables, SMPS, NIC, Various ports, etc. Computer Peripherals - I/O Devices. Storage devices, Interface cards – Buses – Firmware
2	Familiarization of Boot process
3	Familiarizing installation of Linux and Windows operating systems
4	Familiarizing basic Unix/Linux commands - ls, mkdir, cp, mv, grep, rmdir, chmod, useradd, passwd, history, dmesg, cpuinfo, uname, du, time, write, fdisk
5	Familiarizing networking hardware - RJ45, UTP, fibre, switch, NIC, router, Wireless Access Point (WAP), modem
6	Familiarizing basic networking commands - ifconfig, ping, traceroute, nslookup, ssh, scp, telnet, ftp
7	View network traffic using Wireshark/Packet tracer

8	Familiarizing the steps how to configure and establishing a network connecting
9	Shell programming in Linux(bash)
10	Create a web page and deploy on a local web server.
11	Use Javascript to validate forms.
12	Create an image slider using HTML, CSS, and JavaScript. Allow users to navigate between images using previous and next buttons.
13	Familiarisation of LaTeX - Basic only
14	Familiarisation of Development Environments - Visual studio code, Sublime Text, Atom
15	Introducing Repositories - Git / Bitbucket

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)**	**Internal Exam**	**Total**
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

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 the student will be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Experiment with the fundamental hardware components of a computer and how to interface them with software systems.	**K3**
CO2	Make use of the command line of Linux operating system and shell programming.	**K3**
CO3	Experiment with the data network communication scenarios using Wireshark.	**K3**
CO4	Develop basic websites using HTML, CSS & JavaScript and manage the versions.	**K3**

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							3
CO2	3	3	3	3	3							3
CO3	3	3	3	3	3							3
CO4	3	3	3	3	3							3

1: Slight (Low),2: Moderate (Medium),3: Substantial (High), : No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Invitation to ComputerScience	G. Michael Schneider, Judith Gersting	Cengage	2/e, 2020
2	LINUX for Developers:Jumpstart Your LinuxProgramming Skills	William Rothwell	Pearson	1/e, 2018
3	HTML, CSS, and JavaScript -All in One, Sams Teach Yourself	Julie C. Meloni Jennifer Kyrnin	Pearson	1/e, 2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach	Irv Englander	Wiley	5/e, 2014
2	Mastering Git : Attain expertlevel proficiency with Git forenhanced productivity and efficient collaboration	Jakub Narębski	Packt	1/e, 2016
3	Web Design with HTML, CSS,JavaScript, and Jquery.	Jon Duckett	Wiley	1/e, 2014

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://overthewire.org/wargames/bandit/
2	https://www.w3schools.com/

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 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 understandingof the theoretical background related to the experiments.
2. **Conduct of Experiments (7 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, andtroubleshooting skills during the experiments.
    - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (6 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 andmaintaining a well-organized fair record.
4. **Viva Voce (5 Marks)**
    - Oral Examination: Ability to explain the experiment, results and underlying principlesduring a viva voce session.

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

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 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 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 qualityof 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 thesubject.

5. **Record (5 Marks)**

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

PROGRAMME CORE 1

SEMESTER S2

NETWORK THEORY

(COMMON TO EC, EA, AE, EV BRANCHES)

Course Code	**PCECT205**	**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 analyze electrical networks using Mesh / Nodal methods /network theorems
2. To analyze transient behavior of electrical networks using Laplace transform
3. To identify the network functions and parameters of single-port and two-port networks.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Network fundamentals and analysis methods:** Concept of networks and circuits, Circuit variables, Ideal and practical sources, Independent and dependent sources, Source transformation, Kirchhoff's laws. Mesh analysis, Node analysis, Super-mesh analysis and super-node analysis applied to both DC and AC networks containing independent and dependent sources.	11

2	**Network theorems and applications**: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Millman's theorem and Maximum power transfer theorem for the analysis of DC and AC networks having independent and dependent sources.	**11**
3	**Laplace transforms and transient analysis:** Laplace transforms of standard signals and common functions, Laplace transform theorems (proof not required), Inverse Laplace transforms, Solution of differential equations. Transformation of basic signals and circuits to s – domain with and without initial conditions. Transient analysis of RL, RC and RLC networks with DC, impulse, step and sinusoidal inputs. Analysis of low pass and high pass RC circuits using Laplace transforms.	**11**
4	**Network functions and two-port parameters:** Network functions for single-port and two-port networks, Properties of driving point and transfer functions, Significance of poles and zeros of network functions, Pole-zero plot. Impedance, Admittance, Hybrid and Transmission parameters of two-port networks, Reciprocity and symmetry conditions (derivation not required), Inter-relationships between parameters, Series and parallel connections of two-port networks.	**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	Analyze electrical networks using mesh and node methods	**K4**
CO2	Apply network theorems to analyze electrical networks	**K3**
CO3	Analyze transient behavior of electrical networks using Laplace transforms	**K4**
CO4	Identify the network functions and parameters of single-port and two-port networks	**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									2
CO2	3	3	2									2
CO3	3	3	3	2								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	Basic Engineering Circuit Analysis	R. Mark Nelms, J. David	Irwin Wiley	12/e, 2020
2	Network Analysis and Synthesis	Franklin F. Kuo	Wiley	2/e, 2012
3	Circuits and Networks-Analysis and Synthesis	Sudhakar A and Shyammohan S. P	McGraw Hill	5/e, 2015
4	Network Analysis	Van Valkenburg M.E	Prentice Hall India	Revised 3/e,2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Circuit Theory Analysis and Synthesis	Abhijit Chakrabarti	Dhanpat Rai & Co.	Revised 7/e, 2018
2	Electric Circuits – Schaum's Outline Series	Joseph A. Edminister, K. Rao and M. Nahvi	McGraw-Hill	5/e, 2017
3	Electric Circuits and Networks	K. S. Suresh Kumar	Pearson	2008
4	Network analysis and synthesis	Ravish R	McGraw-Hil	2/e,2015

SEMESTER 2

MEASUREMENTS AND INSTRUMENTATION

(ELECTRICAL AND ELECTRONICS ENGINEERING)

Course Code	**PCEET205**	**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)	Nil	**Course Type**	PC -Theory

Course Objectives:

1. To introduce the concepts of electrical measurement systems and instrumentation.
2. To discuss the principles of operation and construction of basic instruments for measuring circuit parameters, magnetic quantities, and passive parameters using bridge circuits, sensors, and transducers.
3. To introduce modern digital instrumentation systems.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	Functional Elements of Measurements Systems- Block Schematic and brief operation of building blocks Standards of Measurements- Static characteristics (accuracy, precision, linearity, resolution), Need for calibration, Types of errors Instruments- Classification; Operating Forces and Torques: deflecting, controlling and damping torques- Gravity and spring control; air, fluid friction and eddy current damping. Measurement of Voltage and Current- Moving Coil and Moving Iron types., Range Extension – shunts and multipliers (Include simple problems of range extension)	**11**
2	Magnetic Measurement- Flux Meter, Determination of BH Curve - Hysteresis Loop (Method of Reversal). Measurement of Resistance,	**11**

	Wheatstone's Bridge, Kelvin's Double Bridge (Simple Problems), Loss of Charge Method, Measurement of Earth Resistance. Measurement of Inductance- Maxwell's Inductance Bridge, Measurement of Capacitance - Schering's Bridge, Measurement of Frequency- Wien Bridge (Include Simple Problems) Q-meter, LCR Meters (Description only)	
3	Measurement of Power and Energy: Measurement of Power using Dynamometer type wattmeter, Three phase Power Measurement using Two Wattmeter Method (Include Phasor Diagrams and Expressions, Include simple problems of two wattmeter method) Measurement of Energy Using Induction type Energy Meter, Two Element Energy Meter Instrument Transformers-CT and PT- Principle of Operation- Range Extension Basic Principles of Electronic Multimeter, Digital Voltmeter Digital Energy Meter, TOD Meter, Smart Metering, Bidirectional Meters (Description Only)	**11**
4	Block Schematic of electronic instrumentation system – role of sensors and transducers Classification of Temperature transducers- Principle of operation of Thermistors and RTD Classification of flow transducers- Principle of operation of Electromagnetic and ultrasonic types Strain gauge: Basic working principle, types and applications; Measurement of angular speed and luminous intensity Principles of Digital Data Acquisition systems - Role of Signal conditioning systems (Basic Principles only)- Phasor Measurement Unit (Block Schematic and Description Only) CRO, DSO and Harmonic Analyzers: Block Diagram, Basic Principles and applications only Virtual Instrumentation Systems: Block schematic and Description only IOT and Data analytics for Industrial Process- Case study on Smart Grid	**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	Classify various parameters and errors associated with measuring instruments.	**K2**
CO2	Apply suitable methods for the measurement of current, voltage, power and energy.	**K3**
CO3	Understand suitable methods for the measurement of magnetic quantities, resistance, inductance and capacitance.	**K2**
CO4	Describe the working principle, selection criteria and applications of various sensors and transducers in relation to measurements systems.	**K2**
CO5	Explain the operation of digital measurement systems.	**K2**
CO6	Discuss the applications of modern instrumentation schemes for industrial process	**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	-	-	-	-	-	2
CO3	3	3	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	2	-	-	-	-	-	-	2
CO5	3	2	-	-	2	-	-	-	-	-	-	2
CO6	3	2	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	A course in Electrical and Electronic Measurements & Instrumentation	K. Sawhney	Dhanpat Rai & Co.	2023
2	A course in Electrical & Electronic Measurement & Instrumentation	J. B. Gupta	S K Kataria & Sons	14th Ed., 2014
3	Electrical Measurements & Measuring Instruments	Golding E.W and Widdis	Wheeler Pub.	3rd Ed.,2011
4	Electronic Instrumentation	H. S. Kalsi	McGraw Hill, New Delhi	4th Ed., 2019
5	Principles of Electrical Measurement	S Tumanski	Taylor & Francis.	2006
6	Electronic Instrumentation and Measurements	David A Bel	Oxford	3rd Ed,, 2013

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Modern Electronic Instrumentation and Measurement Techniques	Albert D. Helfrick, Cooper William D	Prentice Hall of India	2016
2	Basic Electrical Measurements	Stout M.B	Prentice Hall	2012
3	Electronic Measurements & Instrumentation	Oliver & Cage	McGraw Hill	2017
4	Doebelin’s Measurements Systems	E.O Doebelin and D.N Manik	McGraw Hill Education (India) Pvt. Ltd.	7th Ed., 2019
5	Electrical and Electronics Measurements and Instrumentation	P.Purkait, B.Biswas, S.Das and C. Koley	McGraw Hill Education (India) Pvt. Ltd.,	2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/105/108105153/ https://archive.nptel.ac.in/courses/108/108/108108147/
2	https://archive.nptel.ac.in/courses/108/105/108105153/
3	https://archive.nptel.ac.in/courses/108/105/108105153/
4	https://archive.nptel.ac.in/courses/108/108/108108147/ https://archive.nptel.ac.in/courses/106/105/106105166/

SEMESTER S2

ANATOMY AND PHYSIOLOGY FOR BIOMEDICAL ENGINEERING

(BIOMEDICAL ENGINEERING)

Course Code	**PCBMT205**	**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 serve as a foundation course for engineers in health care field.
2. To introduce the basic anatomy of the major systems of engineering importance in human body.
3. To study the basic physiological concepts of these systems.
4. To explore the basic engineering principles related to human physiology

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Anatomy & Physiology: Definitions, structural & functional organization of human body – cells, tissues, organs & systems, Cell: Basic structure, organelles & their functions. Cell membrane – structure, transport across cell membranes – passive transport (passive diffusion and facilitated diffusion) active transport – primary – Na^+-K^+ pump & secondary transport - co transport & counter transport. Skeletal system: functions of skeletal system, Bone – classification & composition, structure of long bone – compact and spongy bone. Joints in human body – classification and possible movements.	11

2	Nervous System: General organization, Neurons – structure & types, Central nervous system – Brain - structure and functions of each parts, Spinal cord - structure – spinal and cranial nerves, spinal reflex, Brain Stem – basic structure & functions. Peripheral nervous system: Efferent & afferent division. Autonomic nervous system: Sympathetic & Parasympathetic nervous system Special senses –Organ of vision, hearing & equilibrium, taste and smell – structure & basic mechanisms. Integumentary system (basic structure & function only)	**11**
3	Blood - the composition of blood (blood proteins and blood cells & their function), blood groups. Blood clotting. Lymphatic system and its functions. Cardiovascular system - major blood vessels, Heart- structure of heart and its electrical activity (ECG, Heart rate – normal & abnormal), Heart sounds & murmurs, Stroke volume & cardiac output, blood pressure. Circulatory systems-Systemic circulation and pulmonary circulation. Respiratory system - structure and organization of organs concerned with respiration, structure of lungs, mechanics of respiration, Gaseous exchange, Gas transport.	**11**
4	Muscular System - Types of muscles, Skeletal muscle - levels of organization, structure, mechanism of muscle contraction & relaxation. Urinary System - Structure and function of organs, kidneys, nephron – structure and types, Basic renal processes involved in urine formation, micturition (definition only) Digestive system – Anatomy and Functions of Components of the Digestive System – basic digestive processes: motility, secretion, digestion, and absorption	**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	Introduce the functional organization of human body and understand the structure and functions of skeletal system	**K2**
CO2	Understand the structure and functions of nervous system	**K2**
CO3	Identify the components of blood and physiology of cardiovascular and respiratory systems	**K3**
CO4	Interpret the structure and functions of muscular, urinary systems and digestive system.	**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	-	-	-	2
CO2	-	2	-	-	-	2	-	1	-	-	-	2
CO3	-	2	-	-	-	2	-	1	-	-	-	2
CO4	-	2	-	-	-	2	-	1	-	-	-	2

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Human Physiology: From Cells to Systems	Laura lee Sherwood	Cengage Learning, USA	9th ed., 2014
2	Textbook of Medical Physiology	Arthur C. Guyton, John E. Hall	W.B. Saunders Company	10th ed., 2000

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Ross and Wilson: Anatomy and Physiology in Health and Illness	Anne Waugh, Allison Grant	Churchill Livingstone	9th ed., 2001
2	Essentials of Anatomy and Physiology	Tina Sanders, Dr Valerie Scanlon	F.A. Davis Company	5th ed., 2006

SEMESTER S2

BASIC ANATOMY & PHYSIOLOGY FOR BIOMEDICAL ENGINEERS

(ELECTRONICS AND BIOMEDICAL ENGINEERING)

Course Code	**PCEBT205**	**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 serve as a foundation course for engineers in health care field.
2. To introduce the basic anatomy of the major systems in human body.
3. To analyze and understand the functioning of the major systems.
4. To explore the basic engineering principles related to human physiology.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Anatomy & Physiology:** Definition & relationship of structural & functional organization of human body. **Homeostasis:** Body fluids ICF & ECF, fluid compartments in human body, – Homeostatic control System- negative & positive feedback and feed forward mechanisms. **Cell:** Structure, membrane & Transport mechanisms. RMP - Action potentials – ionic basis of generation - Nernst potential, Goldman Hodgkin Katz equation.	11

2	**Nervous System:** General organization - Central nervous system, Cerebrum – Cerebral cortex — motor, sensory, language & association areas – major functions. Basal ganglia, Thalamus & Hypothalamus – functions. Cerebellum, Brain Stem – basic structure& functions. Spinal cord - spinal reflex. Neurons – structure & types, Mechanisms of Nerve impulses, Synapses & Neuronal Integration Synaptic potentials – EPSP & IPSP -Neurotransmitters – types **Special senses:** Organ of vision, hearing & equilibrium, taste and smell – structure & basic mechanisms	**11**
3	**Blood:** The composition of blood (blood proteins and blood cells & their function), hematocrit, blood groups, blood clotting. Major arteries & veins **Lymph and its function.** **Cardiovascular system**: Major blood vessels, Circulatory Systems- Systemic circulation and pulmonary circulation Heart- structure of heart and its electrical activity, Auto rhythmic cells - cardiac action potentials, cardiac cycle (ECG, Heart rate – normal & abnormal), myocardial ischemia & infraction, atherosclerosis, Heart sounds & murmurs, Stroke volume & cardiac output, blood pressure. **Respiratory system**: Structure and organization of organs, mechanics of respiration, Basics of gas exchange	**11**
4	**Skeletal system:** functions of skeletal system, Bone – classification & composition- structure of long bone – compact and spongy bone. Types of joints and function. Types of cartilage and function. **Muscular System:** Organization, Types of muscles - skeletal, cardiac and smooth muscles, mechanism of muscle contraction & relaxation. **Urinary System:** Structure and function of organs, kidneys- nephron – structure, components, Basic renal processes involved in urine formation, micturition – definition and mechanism	**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	Familiarize the functional organization of human body and understand the basic principles of human anatomy & physiology.	**K2**
CO2	Understand the structure and functions of nervous system and special senses.	**K2**
CO3	Identify the components of blood and understand the structure and functions of cardiovascular and respiratory systems	**K2**
CO4	Understand the structure and functions of skeletal, muscular and urinary systems.	**K2**

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

CO-PO Mapping Table: (Mapping of Course Outcomes to Program Outcomes)

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

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Human Physiology: From Cells to Systems	Laura lee Sherwood	Cengage Learning, USA	9e/, 2014
2	Textbook of Medical Physiology	Arthur C. Guyton, John E. Hall	W.B. Saunders Company	10e/ 2000

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Ross and Wilson: Anatomy and Physiology in Health and Illness	Anne Waugh, Allison Grant	Churchill Livingstone	9e/ 2001
2	Essentials of Anatomy and Physiology	Tina Sanders, Dr Valerie Scanlon	F.A. Davis Company	5e/ 2006

SEMESTER S2

ANATOMY AND PHYSIOLOGY FOR BIOMEDICAL ENGINEERING

(BIOMEDICAL AND ROBOTIC ENGINEERING)

Course Code	**PCBRT205**	**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)	NIL	**Course Type**	Theory

Course Objectives:

1. To serve as a foundation course for engineers in health care field.
2. To introduce the basic anatomy of the major systems of engineering importance in human body.
3. To study the basic physiological concepts of systems.
4. To explore the basic engineering principles related to human physiology.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Importance of Anatomy& Physiology for Biomedical Engineering. Introduction to Anatomy & Physiology: Definitions, structural & functional organization of human body – cells, tissues, organs & systems, Cell: Basic structure, organelles & their functions. Cell membrane – structure, transport across cell membranes – passive transport (passive diffusion and facilitated diffusion) active transport – primary – Na^+-K^+ pump & secondary transport - co transport & counter transport. Skeletal system: functions of skeletal system, Bone – classification & composition, structure of long bone– compact and spongy bone. Joints in human body – classification and possible movements.	11

2	Nervous System: General organization, Neurons – structure & types, Central nervous system – Brain - structure and functions of each parts, Spinal cord - structure – spinal and cranial nerves, spinal reflex, Brain Stem – basic structure & functions. Peripheral nervous system: Efferent & afferent division. Autonomic nervous system: Sympathetic & Parasympathetic nervous system Special senses –Organ of vision, hearing & equilibrium, taste and smell – structure & basic mechanisms. Integumentary system (basic structure & function only)	**11**
3	Blood - the composition of blood (blood proteins and blood cells & their function), blood groups. Blood clotting. Lymphatic system and its functions. Cardiovascular system - major blood vessels, Heart- structure of heart and its electrical activity (ECG, Heart rate – normal & abnormal), Heart sounds & murmurs, Stroke volume & cardiac output, blood pressure. Circulatory systems-Systemic circulation and pulmonary circulation. Respiratory system - structure and organization of organs concerned with respiration, structure of lungs, mechanics of respiration, Gaseous exchange, Gas transport.	**11**
4	Muscular System - Types of muscles, Skeletal muscle-levels of organization, structure, mechanism of muscle contraction & relaxation. Urinary System-Structure and function of organs, kidneys, nephron – structure and types, Basic renal processes involved in urine formation, micturition (definition only) Digestive system – Anatomy and Functions of Components of the Digestive System – basic digestive processes: motility, secretion, digestion, and absorption. Applications of Anatomy & Physiology in medical technology for improving patient care.	**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	Introduce the functional organization of human body and understand the structure and functions of skeletal system	**K2**
CO2	Understand the structure and functions of nervous system.	**K2**
CO3	Identify the components of blood and physiology of cardiovascular and respiratory systems	**K3**
CO4	Interpret the structure and functions of muscular, urinary systems and digestive system.	**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	-	-	-	2
CO2	-	2	-	-	-	2	-	1	-	-	-	2
CO3	-	2	-	-	-	2	-	1	-	-	-	2
CO4	-	2	-	-	-	2	-	1	-	-	-	2

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Human Physiology: From Cells to Systems	Laura lee Sherwood	Cengage Learning, USA	9th ed., 2014
2	Textbook of Medical Physiology	Arthur C. Guyton, John E. Hall	W.B. Saunders Company	10th ed., 2000
3	Ross and Wilson: Anatomy and Physiology in Health and Illness	Anne Waugh, Allison Grant	Churchill Livingstone	9th ed., 2001

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Essentials of Anatomy and Physiology	Tina Sanders, Dr Valerie Scanlon	F.A. Davis Company	5th ed., 2006
2	Anatomy and physiology in health and illness.	Ross and Wilson	Waugh & Grant	2022

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://www.skillmd.com/course/anatomy-nptel-video-lessons/, https://www.youtube.com/watch?v=ydZkJzl4IVk,
2	https://nptel.ac.in/courses/109104029,
3	http://www.digimat.in/nptel/courses/video/103103133/L01.html, http://www.digimat.in/nptel/courses/video/103103133/L01.html
4	https://www.youtube.com/watch?v=aIS5aBKsIwk, https://www.youtube.com/watch?v=QjihqB2rHX8,http://acl.digimat.in/nptel/courses/video/102104058/L57.html

SEMESTER S2

LOGIC CIRCUIT DESIGN

(ELECTRONICS AND INSTRUMENTATION)

Course Code	**PCEIT205**	**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)	GYEST104 Introduction to Electrical & Electronics Engineering	**Course Type**	Theory

Course Objectives:

1. To understand the number systems in digital systems.
2. To introduce the basic postulates of Boolean algebra, digital logic gates and Boolean expressions
3. To design and implement combinational and sequential circuits.
4. To familiarize different logic families.
5. To study the basics of Verilog HDL.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	Digital systems - Binary and hexadecimal number systems, Methods of base conversions, Binary and hexadecimal arithmetic, Representation of signed numbers(1's complement, 2's complement,9's complement, 10's complement forms). Fixed and floating point numbers, decimal codes – BCD, Gray codes, Excess 3 code, ASCII code. Boolean Algebra - Basic definitions and axiomatic definition of Boolean algebra, Basic theorems and properties of Boolean algebra,	**11**

	De-Morgan's Theorems, Boolean functions, canonical and standard forms, Digital logic gates and their truth table. Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization.	
2	Combinational Logic Systems – Half and full adders, 4 bit ripple carry adder, Subtractors, BCD Adder, Magnitude Comparators, Decoders and Encoders, Multiplexers and Demultiplexer. Basic Introduction to Programmable logic devices (PLD) and FPGA. Verilog HDL – Basic language elements, identifiers and operators. Verilog implementation of logic gates and combinational circuits.	**11**
3	Latches and Flipflops – SR Latch, SR Flipflop, JK, D and T flipflops, Master slave JK FF, Excitation table and characteristic equation, conversion of flipflops. Registers - Shift registers-SIPO, SISO, PISO, PIPO, Bidirectional. Verilog modeling of flipflops	**11**
4	Counters- Ripple counter, Mod 10 Counter, Ring counter and Johnsons- Design of Asynchronous and Synchronous counters, Mod N counter, sequence generator. Verilog modelling of asynchronous and synchronous counters. Verilog implementation of sequence generator. Electrical characteristics of TTL and CMOS logic families – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power delay product. TTL inverter - circuit description and operation, CMOS inverter - circuit description and operation, CMOS NAND, CMOS NOR.	**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	Explain the elements of digital system abstractions such as digital representations of information, digital logic and Boolean algebra	**K2**
CO2	Design and implement combinational logic circuits	**K3**
CO3	Design and implement sequential logic circuits	**K3**
CO4	Design and implement combinational and sequential logic using Verilog HDL	**K4**
CO5	Compare different logic families	**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	3	3									
CO3	3	3	3									
CO4	3	3	3	2	3							
CO5	3	3										

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Fundamentals	Thomas L. Floyd	Pearson Education	11th Edition, 2017
2	Introduction to logic circuits and logic design with verilog	Brock J. Lameres	Springer	2nd Edition, 2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog	M Morris Mano, Michael D. Ciletti	Pearson Education	6th Edition, 2018
2	Digital Design Verilog HDL and Fundamentals	Joseph Cvanagh	CRC Press	1st Edition, 2008
3	Fundamentals of digital circuits	Kumar A. Anand	PHI	4th Edition, 2016
4	Verilog HDL: A Guide to Digital Design And Synthesis	Samir Palnitkar	Pearson	2nd Edition, 2003

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/117/106/117106086/ https://archive.nptel.ac.in/courses/106/105/106105185/
2	https://archive.nptel.ac.in/courses/117/106/117106086/ https://archive.nptel.ac.in/courses/106/105/106105185/
3	https://archive.nptel.ac.in/courses/117/106/117106086/ https://archive.nptel.ac.in/courses/106/105/106105185/
4	https://archive.nptel.ac.in/courses/117/106/117106086/ https://archive.nptel.ac.in/courses/106/105/106105185/

SEMESTER S 2

BASIC OF INSTRUMENTATION ENGINEERING

(INSTRUMENTATION AND CONTROL ENGINEERING)

Course Code	**PCICT205**	**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. Understand the Fundamentals of Instrumentation and Control Engineering and functional elements of measurement systems.
2. Describe about functions of a control system and master Instrument Characteristics.
3. Study input-output configuration of instruments and develop Proficiency in Calibration
4. Analyse and Mitigate Measurement Errors and measurement noise.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	INTRODUCTION TO INSTRUMENTATION & CONTROL ENGINEERING- Definition-scope and importance- application of instrumentation in different fields like petrochemical, Biomedical, pharmaceutical and food processing. FUNCTIONAL ELEMENTS OF MEASUREMENT SYSTEM: Introduction to instrument systems - Typical applications of instrument systems. Basic description of the functional elements of the measurement	**12**

	system with examples. TRANSDUCERS AND INSTRUMENT TYPES: Definition of transducers. Role of transducers in instrumentation. Classification of instruments: Active and passive instruments - Null-type and deflection-type instruments - Analogue and digital instruments - Indicating instruments and instruments with a signal output -Manually operated and automatic type, Self-generating and power operated types, Contacting and non-contacting types - Smart and non-smart instruments	
2	FUNCTIONAL ELEMENTS OF CONTROL SYSTEM: Need of Control systems – Role of error detectors – Block diagram for a control system with examples. MEASUREMENT SYSTEM PERFORMANCE: Static characteristics of instruments. Accuracy and precision, static sensitivity, linearity, hysteresis, threshold, dead time, dead zone, resolution or discrimination. static error, static correction. Scale range and span, reproducibility and drift, repeatability. Dynamic characteristics of instruments. Understating of (1) Zero order instrument (2) First order instrument (3) Second order instrument.	**10**
3	CALIBRATION OF MEASURING SENSORS AND INSTRUMENTS: Standards and calibration – Necessity of calibration- Careful instrument design, Principles of calibration-Control of calibration environment- Calibration chain and traceability-Calibration records - Intelligent instruments. TYPES OF INPUTS: Input output configuration of measuring instruments and measurement systems. Desired inputs, interfering inputs, modifying inputs. Methods of correction for interfering and modifying inputs. Loading effects. Input and output impedances. Input impedances, input admittance, output impedances, output admittance.	**11**

4	MEASUREMENT NOISE: Noise, signal to noise ratio, sources of noise, Johnson noise, power spectrum density. Sources of measurement noise-Inductive Coupling-Capacitive (electrostatic) coupling - Noise due to multiple earths-Noise in the form of voltage. ERRORS DURING THE MEASUREMENT PROCESS: Errors in measurements, true value, Limiting errors (Guarantee errors). Relative (fractional) limiting error. Combination of quantities with limiting errors. Known errors, types of errors, gross errors, systematic errors, instrumental errors, environmental errors, observational errors. Random (residual) errors. Reduction of systematic errors - Careful instrument design - Method of opposing inputs -Calibration - Manual correction of output reading.	**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	Demonstrate a comprehensive understanding of instrumentation and control engineering principles and the performance characteristics of different types of instruments.	**K2**
CO2	Develop a thorough understanding of the static and dynamic characteristics of instruments enabling effective evaluation and utilization of instrumentation in various applications.	**K2**
CO3	Develop a deep understanding of the principles of calibration and analysing input-output relationships in measurement systems	**K2**
CO4	Demonstrate a comprehensive understanding of noise and errors in measurement.	**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
CO2	3											3
CO3	3											3
CO4	3											3

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Measurements and Instrumentation Principles.	Alan S Morris	Elsevier Butterworth Heinemann	3rd edition, 2001
2	A course in Mechanical Measurement and Instrumentation.	A.K Sawhney	Dhanpat Rai & Co.	12th edition, 2017
3	Instrumentation Devices & Systems.	C.S. Rangan, G.R. Sarma, V.S.V. Mani,	Tata McGraw- Hill publishing company Ltd.	2017
4	Mechanical Measurements	S P Venkateshan	Ane Books	2nd edition, 2015

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Measurement systems: Application and design,	Ernest. O Doeblin	McGraw Hill Higher Education	5th edition, 2003
2	Transducers and Instrumentation	D V S Murty	Prentice Hall India Learning Private Limited	2nd edition, 2008

Video Links (NPTEL, SWAYAM…)

	Link ID
1	https://nptel.ac.in/courses/108102191

SEMESTER S2

SENSORS AND ACTUATORS

(CYBER PHYSICAL)

Course Code	**PCCPT205**	**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. Provide a comprehensive understanding of fundamental concepts of sensors and actuators.
2. Explore various types of sensors, including mechanical, electromechanical, thermal, inductive, and gas sensors
3. Apply knowledge of actuators in different systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Sensors, Transducers and Actuators: Basics of Energy transformation: Transducers, Sensors and Actuators , Principles, Classification, Parameters, and Characteristics, Environmental Parameters (EP), Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges	11
2	Inductive Sensors- Sensitivity and Linearity of the Sensor, Types- Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors using	11

	Quartz Resonators, Ultrasonic Sensors. Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor. Introduction – Basic Characteristics – Types of Photosensistors /Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors	
3	Gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications	**11**
4	Working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators.	**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	Remember Fundamental Concepts of Sensors and Actuators	**K1**
CO2	Understand Mechanical and Electromechanical Sensors	**K2**
CO3	Explain Thermal and Inductive Sensors	**K2**
CO4	Identify Different Gas Sensors	**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									
CO3	3	2	2			1	1					
CO4	3	2	2			1	1					
CO5	3	2	2			1						

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Sensors and Transducers,	D. Patranabis	PHI Learning Private Limited.	Second edition
2	Mechatronics	W. Bolton	Pearson Education Limited.	
3	Sensors and Actuators: Engineering System Instrumentation	Clarence W. de Silva	CRC Press	2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	MEMS: A Practical Guide to Design, Analysis, and Applications	Jan Korvink and Oliver Paul	Springer	2018
2	Handbook of Modern Sensors: Physics, Designs, and Applications	Jacob Fraden	Springer	5th edition, 2016
3	Principles of Measurement Systems	John P. Bentley	Pearson	4th edition, 2005
4	Piezoelectric Sensors and Actuators: Fundamentals and Applications	Stefan Johann Rupitsch	Springer	2018

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
Module - I	https://onlinecourses.nptel.ac.in/noc21_ee32/preview
Module - IV	https://onlinecourses.nptel.ac.in/noc21_ee32/preview

SEMESTER S2

DIGITAL ELECTRONICS

(ELECTRONICS AND COMPUTER ENGINEERING)

Course Code	**PCERT205**	**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)	Nil	**Course Type**	Theory

Course Objectives:

1. Understand the fundamental building blocks of Digital Electronics and Boolean algebra for manipulating digital information.
2. Design digital circuits (combinational and sequential) for processing and storing information.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Number Systems: Introduction to number systems (decimal, binary, octal, hexadecimal) and their bases - conversion methods between decimal, binary, octal and hexadecimal number systems. Arithmetic - Binary Addition, Binary Multiplication and Binary Division. Addition of BCD, Octal and Hexadecimal numbers. Representing Negative Numbers - Signed Numbers & Complements, Subtraction with Complements (Binary, BCD, Octal and Hexadecimal). Introduction to alternative coding schemes - BCD, Gray codes, and Excess-3 codes.	**11**

2	Introduction to Boolean Algebra - Postulates (Idempotence, Commutativity, Associativity, Distributive Property, etc.) and Basic Theorems (like De-Morgan's Theorem), Minimization of Boolean expressions - Canonical and Standard Forms, Karnaugh map Minimization (up to four variables), Don't-Care Conditions. Digital Logic Gates – Implementation of Boolean functions (including those simplified using Karnaugh maps) using combinations of basic logic gates & implementation using universal gates.	**11**
3	Combinational and Arithmetic Circuits Combinatorial Logic Systems - Data Encoders and Decoders, Data Selection and Distribution (Mux & Demux), Code Converters, Comparators. Arithmetic Circuits - Half and Full Adder, Half & Full Subtractor, Binary Parallel Adder, BCD Adder.	**10**
4	Sequential Logic Circuits: Sequential Circuits Fundamentals, Flip-flops - SR, JK, T and D, Conversion of Flipflops, Excitation table and characteristic equation. Asynchronous (Binary and BCD counters) and Synchronous counter design (Binary up, down and up-down counter, BCD counter), timing sequences and state diagrams, Mod N counter. Shift registers - SIPO, SISO, PISO, PIPO, timing sequences and state diagrams. Shift Registers with parallel Load/Shift, Ring counter and Johnson counter	**12**

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	Explain the fundamental concepts of number systems (decimal, binary, octal, hexadecimal) including their bases and conversion techniques.	**K2**
CO2	Utilize Boolean postulates and theorems to simplify logic expressions and implement circuits using basic logic gates	**K3**
CO3	Implement combinational logic circuits for data processing and manipulation.	**K3**
CO4	Describe the operation of different flip-flops and implement basic sequential circuits.	**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	1										2
CO2	3	2	2									2
CO3	3	2	2									2
CO4	3	2	2									2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Design	Mano M.M, Ciletti M.D	Pearson India	4th Edition, 2006
2	Digital Fundamentals	Thomas L Floyd, Digital	Pearson Education	10th Edition , 2009
3	Modern digital Electronics	R.P. Jain	Tata McGraw Hill,	4th Edition, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Principles and Design	Donald D Givone	Tata McGraw Hill	1st Edition, 2003
2	Fundamentals of Digital Circuits	A. Ananthakumar	Prentice Hall	2nd Edition, 2016
3	Digital Design: Principles and Practices	Wakerly J.F	Pearson India	4th edition, 2008
4	Digital Electronics – An introduction to theory and practice	W.H. Gothmann,	PHI	2nd Edition,2006

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	NPTEL course: “Digital Circuits and Systems” by Prof. S. Srinivasan, Video Lecture No: 1, Introduction To Digital Circuits (https://nptel.ac.in/courses/117106086)
2	NPTEL course: “Digital Circuits and Systems” by Prof. S. Srinivasan, Video Lecture No: 7, Logic Minimization Using Karnaugh Maps (https://nptel.ac.in/courses/117106086)
3	NPTEL course: “Digital Circuits and Systems” by Prof. S. Srinivasan, Video Lecture No: 9, Code Converters (https://nptel.ac.in/courses/117106086)
4	NPTEL course: “Digital Circuits and Systems” by Prof. S. Srinivasan, Video Lecture No: 20, Up/ Down Counters (https://nptel.ac.in/courses/117106086)

SEMESTER S2

SENSORS AND ACTUATORS FOR ROBOTICS

(ROBOTICS AND ARTIFICIAL ENGINEERING)

Course Code	**PCRAT205**	**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. Understand and discuss the fundamental elementary concepts of Robotics
2. Provide insight into different types of robots
3. Understand basic laws and phenomena on which sensors operate
4. Understand the working principle of different actuators used in robotics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Robotics and Automation: - laws of robot, brief history of robotics, robotic system components, safety measures in robotics Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, humanoids, Cobots, Autonomous robots and Swarm robots, Robotics Applications.	**10**
2	Transducers and sensors: - Static and Dynamic Characteristics, Classification of sensors, Robotic Sensors Proximity sensor- Eddy current proximity sensor, Inductive Proximity sensor, Capacitive Proximity sensor, Force Sensor, Piezoelectric Sensor, Tactile sensor- Touch Sensor/Contact Sensor. Temperature Sensors: Thermistors, Thermocouples	**11**

3	Motion sensor: Encoder sensors, LVDT, Accelerometer, gyroscope-working principle only, PIR sensor, Range Sensors: RF beacons, Ultrasonic Ranging, Reflective beacons Optical sensors: Photoconductive cell, photovoltaic, Photo resistive, Photodiodes, Phototransistors, Laser Range Sensor (LIDAR) Special sensors: Acoustic Sensors, vision and imaging sensors, micro and nano sensors.	**11**
4	Definition, Types, characteristics and selection of Actuators; linear; rotary; cylindrical, Logical and Continuous Actuators, Pneumatic actuator and Electro-Pneumatic actuator; Mechanical actuation systems: Hydraulic actuator - Control valves; applications. Electrical actuating systems: Electric motors as actuators Overview of electric motors. Solid-state switches, Solenoids, - Piezoelectric Actuator.	**12**

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 significance, social impact and future prospects of robotics and automation in various engineering applications	**K2**
CO2	Demonstrate the working principle and characteristics of proximity, force and pressure sensors	**K2**
CO3	Categorize and choose the suitable sensor to measure position, motion, and range of the obstacles	**K2**
CO4	Describe the working principle of different actuators used in robotics	**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	1	1			1		1				1
CO2	2	1	1			1		1				1
CO3	2	1	1			1		1				1
CO4	2	1	1			1	1	1				1

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Sensors and actuators: Engineering system instrumentation	De Silva, Clarence W	CRC Press	2nd edition 2015
2	Instrumentation: Devices and Systems	Rangan& Mani	McGraw Hill	2nd edition, 2017
3	Process Control Instrumentation Technology	Curtis D. Johnson	Prentice Hall India	8th edition, 2005
4	Industrial Robots - Technology, Programming and Applications	Mikell P. Groover et. al	McGraw Hill, Special Edition	2nd edition, 2017
5	Robotics Technology and flexible automation	S.R. Deb	Tata McGraw-Hill Education	2nd edition, 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Sensor, Actuators and their Interfaces: A Multidisciplinary Introductions. (1st eds)	Ida.N	SciTech, Edison	
2	Fundamentals of robotics – Analysis and control	Robert. J. Schilling	Prentice Hall of India	1996

SEMESTER S2

SENSOR TECHNOLOGY FOR ROBOTICS

(ROBOTICS AND AUTOMATION)

Course Code	**PCRUT205**	**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. Understand and discuss the fundamental elementary concepts of Robotics.
2. Provide insight into different types of robots
3. Understand basic laws and phenomena on which sensors operate
4. Understand operation of sensors to measure various physical parameters

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Robotics and Automation: -laws of robot, brief history of robotics, robotic system components, safety measures in robotics Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, humanoids, Cobots, Autonomous robots and Swarm robots, Robotics Applications.	**11**

2	Transducers and sensors: -Static and Dynamic Characteristics, Classification of sensors, Robotic Sensors Proximity sensor- Eddy current proximity sensor, Inductive Proximity sensor, Capacitive Proximity sensor, Force Sensor, Piezoelectric Sensor, Tactile sensor- Touch Sensor/Contact Sensor.	**11**
3	Temperature Sensors: Thermistors, Thermocouples Motion sensor: Encoder sensors, LVDT, Accelerometer, gyroscope-working principle only, PIR sensor, Range Sensors: RF beacons, Ultrasonic Ranging, Reflective beacons	**11**
4	Optical sensors: Photo conductive cell, photo voltaic, Photo resistive, Photodiodes, Phototransistors, Laser Range Sensor (LIDAR), Special sensors: Acoustic Sensors, vision and imaging sensors, micro and nano sensors.	**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 significance, social impact and future prospects of robotics and automation in various engineering applications	**K2**
CO2	Demonstrate the working principle and characteristics of proximity, force and pressure sensors	**K2**
CO3	Categorize and choose the suitable sensor to measure position, motion, and range of the obstacles	**K2**
CO4	Describe the working principle of optical sensor, vision and imaging sensors and micro sensors	**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	1	1			1		1				1
CO2	2	1	1			1		1				1
CO3	2	1	1			1		1				1
CO4	2	1	1			1	1	1				1

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Sensors and actuators: Engineering system instrumentation	De Silva, Clarence W	CRC Press	2nd edition 2015
2	Instrumentation: Devices and Systems	Rangan& Mani	McGraw Hill	2nd edition, 2017
3	Process Control Instrumentation Technology	Curtis D. Johnson	Prentice Hall India	8th edition, 2005
4	Industrial Robots - Technology, Programming and Applications	Mikell P. Groover et. al	McGraw Hill, Special Edition	2nd edition, 2017
5	Robotics Technology and flexible automation	S.R. Deb	Tata McGraw-Hill Education	2nd edition, 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Sensor, Actuators and their Interfaces: Multidisciplinary Introductions. (1st eds)	Ida.N	SciTech, Edison	2011
2	Fundamentals of robotics – Analysis and control	Robert. J. Schilling	Prentice Hall of India	1996

SEMESTER - S2

ANALOG ELECTRONICS CIRCUITS

Course Code	**PCEOT205**	**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:

- At the end of the course the student will be able to explain the working and design of various electronic circuits using BJT, FET, OP-Amp

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Review of Diodes** – Diode circuits – Wave shaping circuits – Rectifiers - Clippers – clampers, Zener diodes – Zener voltage regulators **Introduction to BJT** – BJT Operation- BJT Terminal Voltages and transistor currents – BJT voltage and current amplification – BJT Switching **BJT Biasing** – DC load line and Bias Point- Biasing circuits - fixed bias, voltage divider bias, role of emitter resistance in bias stabilization. Stability factor (derivation of stability factors for voltage divider biasing only) - Numerical problems.	**12**
2	**Introduction to Amplifiers** – BJT amplifier configurations – -Amplifier classifications **RC Coupled Amplifier** – AC load line concepts – Small signal low frequency ac equivalent circuit of CE amplifier –Role of coupling capacitors and emitter bypass capacitor. Calculation of amplifier gains and impedances using h parameter equivalent circuit. **Introduction to FET** - JFET common drain amplifier-Analysis of common drain amplifier using voltage divider biasing. **Multistage amplifiers**: Direct, RC, transformer coupled amplifiers. **Feedback in amplifiers** – Feedback topologies - Effect of positive and negative feedbacks. **Oscillators**: Barkhausen's criterion– RC oscillators (RC Phase shift	**12**

	oscillator and Wein Bridge oscillator) –LC oscillators (Hartley and Colpitt's) – Expression of frequency of oscillations- Crystal oscillator.	
3	**Operational Amplifiers**: Block diagram of Op-Amp. Properties of ideal and practical Op-amps - Gain, CMRR and Slew rate. Open loop and Closed loop Configurations - concept of virtual ground - Negative feedback in Op-amps. Inverting and non- inverting amplifier circuits. Summing and difference amplifiers, Instrumentation amplifier	**12**
4	**OP-AMP Circuits**: Differentiator and Integrator circuits-practical circuits Comparators: Zero crossing and voltage level detectors, Schmitt trigger. Wave form generation using Op-Amps: Square, triangular and ramp generator circuits using Op-Amp- Effect of slew rate on waveform generation. **Timer 555 IC**: Internal diagram of 555IC–Astable and Monostable multi-vibrators using555 IC	**9**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro projects	Internal Ex-1	Internal Ex-2	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 explain the working and design of various electronic circuits using BJT, FET, OP-Amp.

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Design of diode circuits	**K3**
CO2	Model BJT and FET amplifier circuits.	**K3**
CO3	Design amplifier and oscillator circuits using BJT	**K3**
CO4	Explain the basic concepts of Operational amplifier (OPAMP)	**K3**
CO5	Design and develop various OPAMP application circuits.	**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	3									
CO2	2	3	3									
CO3	2	3	3									
CO4	3											
CO5	3	3	3									

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Electronic Devices and Circuits	David A Bell	Oxford Higher Education	
2	Fundamentals of Analog Circuits	Floyd T.L.	Pearson Education	3
3	Electronic Devices and Circuit Theory	Boylestad R. L. and L. Nashelsky	Pearson Education India	
4	Linear Integrated Circuits	Choudhury R.	New Age International Publishers	
5	Op-Amps and Linear Integrated Circuits	Gayakwad R. A.	PHI Learning Pvt. Ltd.	

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Electronic Devices and Circuits	David A Bell	Oxford Higher Education	
2	Fundamentals of Analog Circuits	Floyd T.L.	Pearson Education	3
3	Electronic Devices and Circuit Theory	Boylestad R. L. and L. Nashelsky	Pearson Education India	
4	Linear Integrated Circuits	Choudhury R.	New Age International Publishers	
5	Op-Amps and Linear Integrated Circuits	Gayakwad R. A.	PHI Learning Pvt. Ltd.	