APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

(A State Government University)

B. Tech - 2024

FIRST YEAR SYLLABUS
(GROUP C)

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SEMESTER 1
GROUP C

SEMESTER S1

MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICALSCIENCE - 1

(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, $k\cos\omega x$, $k\sin\omega x$, $ke^{\alpha x}\cos\omega x$, $ke^{\alpha x}\sin\omega x$), 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 beanswered. • Each question can have a maximum of 3sub 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 equationwith constant coefficients.	**K3**
CO3	Compute Laplace transform and apply it to solve ODEs arising inengineering.	**K3**
CO4	Determine the Taylor series and evaluate Fourier series expansion fordifferent 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, ChrisRorres	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 PHYSICAL SCIENCE AND LIFE SCIENCE

(Groups C & D)

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

Course Objectives:

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

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Laser & Fibre Optics** Optical processes – Absorption-Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing – Population inversion- Pumping- Metastable states, Basic components of laser - Active medium - Optical resonant cavity, Construction and working of Ruby laser and CO2 laser, Construction and working Semiconductor laser (qualitative), Properties of laser, Applications of laser. Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres - Multimode and single mode fibers, Acceptance angle, Numerical aperture –Derivation, Applications of optical fibres - Fibre optic communication system (block diagram)	**9**
2	**Interference and Diffraction** Introduction, Principle of super position, Constructive and destructive interference, Optical path, Phase difference and path difference, Cosine law- reflected system- Condition for constructive and destructive interference, Colours in thin films, Newton's Rings-Determination of refractive index of transparent liquids and wavelength, Air wedge-Measurement of thickness of thin sheets. Diffraction-types of diffraction, Diffraction due to a single slit, Diffraction grating – Construction - grating equation, Dispersive and Resolving Power (qualitative).	**9**

3	**Quantum Mechanics** Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle- Absence of electron inside nucleus - Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (qualitative)	**9**
4	**Waves & Acoustics** Waves- transverse and longitudinal waves, Concept of frequency, wavelength and time period (no derivation), Transverse vibrations in a stretched string- derivation of velocity and frequency - laws of transverse vibration. Acoustics- Reverberation and echo, Reverberation time and its significance - Sabine's Formula, Factors affecting acoustics of a building. Ultrasonics-Piezoelectric oscillator, Ultrasonic diffractometer, SONAR, NDT-Pulse echo method, medical application-Ultrasound scanning (qualitative)	**9**

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

Continuous Internal Evaluation Marks (CIE):

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

End Semester Examination Marks (ESE)

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

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

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

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

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

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

1. Continuous Assessment (10 Marks)

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

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

ii. Conduct of Experiments (2 Marks)

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

iii. Lab Reports and Record Keeping (3 Marks)

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

iv. Viva Voce (3 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.*

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 andunderstanding 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 orprogramming 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 thesubject.

Experiment List

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

SEMESTER S1/S2

CHEMISTRY FOR PHYSICAL SCIENCE

(Group C)

Course Code	**GCCYT122**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To equip students with a thorough understanding of chemistry concepts relevant to engineering applications.
2. 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 quality of life.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Engineering Materials** **Fuels:** Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels. Analysis of coal – Proximate analysis- Octane &Cetane Number. Biofuels- Biodiesel-Green Hydrogen. **Lubricants**: Classification - Solid, Semisolid and Liquid lubricants. Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud Point,Pour Point & Aniline Point. **Cement:** Manufacture of Portland cement – Theory of setting and hardeningof cement. **Nanomaterials:** Classification based on Dimension & Materials- Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials – Supercapacitor Materials - Carbon Nanotubes, Fullerenes & Graphene – structure, properties & application. **Polymers:** ABS & Kevlar - Synthesis, properties and applications. Conducting Polymers- Classification – Application.	9
2	**Electrochemistry and Corrosion Science** Electrochemical Cell- Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE & Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode & pH Measurement- Conductivity- Measurement using Digital conductivity meter. Li-ion battery & H_2-O_2 fuel cell (acid electrolyte only) construction and working. Corrosion –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

3	**Instrumental Methods of Analysis** **Molecular Spectroscopy:** Types of spectra- Molecular energy levels - BeerLambert'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:** –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA- Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. **Chromatography-**Gas Chromatography-Principle-Instrumentation- Application – Analysis of chemical composition of exhaust gases. **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 Waste Management: Air Pollution- Sources & Effects- Greenhouse Gases- Ozone depletion. Control methods. Sewage water treatment-Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Solid waste-disposal methods- Composting, Landfill & Incineration.	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

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

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4th edn., 1995
2	Principles of PhysicalChemistry	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 Materialsand Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications ofThermal Analysis	Gabbot, P	Oxford: Blackwell Publishing	2008

Video Links (NPTEL, SWAYAM…)	
Sl 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 understandingof the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of thetheoretical background related to the experiments.

2. **Conduct of Experiments (2 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution ofexperiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, andtroubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (3 Marks)**
   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentationof experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record andmaintaining a well-organized fair record.

2. **Viva Voce (3 Marks)**
   - Oral Examination: Ability to explain the experiment, results and underlying principles duringa 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 Lab Examination (5 Marks)

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

Course Code	**GCEST103**	**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. The course aims to enable students to analyse and solve fundamental mechanics problems

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 only) 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	**8**
4	Curvilinear translation - equations of kinematics projectile motion (solution starting from differential equations) Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis –rotation under a constant moment	**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	2	2										
CO2	3	3										
CO3	3	3										
CO4	3	3										
CO5	3	2										

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 ofIndia.	4th Edition 2008
4	Textbook of Engineering Mechanics	R. K. Bansal	Laxmi publications pvt ltd.	4th Edition 2016

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.	Wiley	*9th Edition 2020*
2	Engineering Mechanics	Kraige	PHI Learning	*2011*

Video Links (NPTEL, SWAYAM…)	
	Link ID
1	https://nptel.ac.in/courses/112106286

SEMESTER S1

INTRODUCTION TO MECHANICAL ENGINEERING & CIVIL ENGINEERING

Course Code	**GCEST104**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	4-0-0-0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Understand thermodynamic cycles and working of IC engines.
2. Understand the refrigeration cycles and psychrometric concepts.
3. Understand the relevance of civil engineering and its various disciplines.
4. Describe the relevance of various building codes and types of buildings as per NBC.
5. Understand different building components and building materials.

SYLLABUS

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

2	Classification of pumps, Description about working with sketches of: Reciprocating pump, Centrifugal pump. Classification of Hydraulic Turbines. Different type of gears and its applications (spur, helical, bevel, worm and worm wheel), List types of clutches and their use, Bearings and their classification (Journal bearing and ball bearing) **Manufacturing Process**: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, SMAW, Soldering and Brazing and their applications. **Machining processes:** Description and operations performed on Lathe, Drilling machine, Milling machine, CNC machine, 3D printing.	**9**
3	**General Introduction to Civil Engineering**: Relevance of Civil Engineering in the overall infrastructural development of the country. Brief introduction to major disciplines of Civil Engineering like Structural Engineering, Geo-technical Engineering, Transportation Engineering, Water Resources Engineering and Environmental Engineering. **Introduction to buildings:** Types of buildings according to character of occupancy as per NBC, Load bearing and non-load bearing building structures, components of a residential building and their functions (conceptonly). Selection of site for a residential building. Building Area Definitions: Built up area, Plinth area, Floor area, Carpet area and Floor area ratio of a building as per KBR. Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion of relevance only).	**9**
4	**Conventional construction materials:** Brick, stone, sand, cement and timber- Classifications, Qualities, Tests and Uses of construction materials. **Cement concrete**: Constituent materials, properties and types.	**9**

	Tests on fresh and hardened concrete - slump test, cube compressivestrength as per IS Codes. **Steel:** Structural steel sections and steel reinforcements – types and uses. **Soil**-Origin of soil-weathering of rocks, types of weathering	

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

Continuous Internal Evaluation Marks (CIE):

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

End Semester Examination Marks (ESE)

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

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

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Basic Mechanical Engineering	Pravin Kumar	Pearson Education	1st Edition,2013
2	A Textbook of Basic MechanicalEngineering	R.K. Rajput	Laxmi Publications	3rd Edition,2017
3	Elements of Mechanical Engineering	K.P. Roy, S.K. Hajra Choudhury, A.K. Hajra Choudhury	Media Promoters & Publishers Pvt. Ltd.	Revised Edition, 2012
4	Fundamentals of Mechanical Engineering	G.S. Sawhney	PHI Learning Pvt. Ltd.	1st Edition,2013
5	Essentials of Civil Engineering	Dalal K R	Charotar Publishing house	1st Edition 2012
6	Engineering Materials(Material Science)	Rangwala S C	Charotar PublishingHouse Pvt Limited	43rd Edition2019
7	Building Materials	Duggal S K	New Age International	5thEdition2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hybrid Electric Vehicles: Principles and Applicationswith Practical Perspectives	Chris Mi and M. AbulMasrur	John Wiley & Sons	2nd Edition, 2017
2	Automotive Engineering Fundamentals	Richard Stone andJeffrey K. Ball	SAE International	st Edition, 2004
3	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David W. Rosen, and Brent Stucker	Springer	nd Edition, 2015
4	Heating, Ventilating, and AirConditioning Analysis and Design	Faye C. McQuiston,Jerald D. Parker, and Jeffrey D. Spitler	John Wiley & Sons	th Edition, 2005
5	Materials for Civil and Construction Engineering	Mamlouk, M.S.,and Zaniewski, J.P	Pearson Publishers	th Edition, 2017
6	Building Construction	Rangwala, S.C andDalal, KB	Charotar Publishing house	4th Edition 2022
7	Construction Technology Vol.I to IV	Chudley, R	Longman group,England CoursePlan	nd Edition 2014
8	Building Construction Volumes1to4	Mckay, W.B.and Mckay,J.K	Pearson India Education Services	th Edition
9	Engineering Geology	Duggal S. K., Pandey H.K. and Rawat N,	Mcgraw Hill Education, New Delhi	st Edition 2017
10	latest Building codes and related rules and regulations.			

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

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. 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.	7

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 MODULARIZATION* :- Problem decomposition as a strategy for solving complex problems, Modularization, Motivation for modularization, Defining and using functions in Python, Functions with multiple return values RECURSION:- Recursion Defined, Reasons for using Recursion, The Call Stack, Recursion and the Stack, Avoiding Circularity in Recursion, *Sample problems - Finding the* ***n****th Fibonacci number, greatest common divisor of two positive integers, the factorial of a positive integer, adding two positive integers, the sum of digits of a positive number **.* ---	**10**

	** 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 - 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	**10**

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	Use 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 Aspectof Mathematical Method	George Pólya	Princeton University Press	2015
3	Creative Problem Solving: AnIntroduction	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 appliedin proffering solution to problems
4. Use a diagram to describe the application of Tower of Hanoi in choosing and analysing anaction 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 theproblem solving process?
6. What effect will be generated if the stage that involves program writing is not observed in theproblem 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 tothat 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 Fibonaccinumber.
11. Recursive function that takes an array of numbers as an input and returns the product of allthe 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 anotherprogram.
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

ENGINEERING WORKSHOP

Course Code	**GCESL106**	**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 enable the student to familiarize various tools, measuring devices, practices and differentmethods employed in the industry.
2. To enable the students to apply this experience while developing product/project for thebenefit of society.

Expt. No.	**Experiments (Minimum 12 Exercises)**
1	General: Introduction to workshop practice, Safety precautions, Shop floor ethics, and Basic First Aid knowledge. Study of mechanical and measurement tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc. and accessories (b) bearings, seals, O-rings, circlips, keys etc.(c)Vernier Calipers, Height Gauge, Depth Gauge, Micrometers, Bevel Protractor etc.
2	Carpentry: Understanding carpentry tools and knowledge of at least one model 1. T –Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joints
3	Foundry: Understanding of foundry tools and knowledge of at least one model 1. Bench Moulding 2. Floor Moulding 3. Core making 4. Pattern making
4	Sheet Metal: Understanding sheet metal working tools and knowledge of at least one model 1. Cylindrical shape 2. Conical shape 3. Prismatic shaped job from sheet metal
5	Fitting: Understanding the tools used for fitting and knowledge of at least one model 1. Square Joint 2. V- Joint 3. Male and female fitting

6	Plumbing: - Understanding plumbing tools and pipe joints, along with practicing one exercise on joining pipes using a minimum of three types of pipe joints
7	Smithy: - Understanding the tools used in smithy. Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in both cold and hot states.Observing the qualitative difference in the hardness of these materials. One exercise on smithy (Square prism).
8	Welding: Understanding welding equipment and practicing at least one welding technique, such as making joints using electric arc welding. Bead formation in horizontal, verticaland overhead positions
9	Rolling: - Objective of rolling, rolling process, practical on two high rolling mill
10	Electroplating: -Electroplating a given job
11	Metrology: Common measuring instruments used in workshop, experiments to find theangle of a dovetail, angle of a taper and the radius of a circular surface. Introduction to instruments Vernier Bevel Protractor, Vernier Depth Gauge, Vernier Height Gauge.
12	Assembly: Demonstration only Dissembling and assembling of 1. Cylinder and piston assembly 2. Tail stock assembly 3. Bicycle 4. Pump or any other machine
13	Machines: Demonstration of the following machines: Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; DrillingMachine.
14	Modern manufacturing methods (**Fab lab/IDEA** Lab - Demonstration only): Power tools, CNC machine tools, 3D printing, Soft Materials cutting using special machines
15	Use of proper Personal Protective Equipments. Measurements using Tape, Ruler, Vernier calipers, screw gauge
16	Measuring the area of a plot with an irregular boundary using a chain and cross staff
17	Measuring the area of a building using Distomat
18	Finding the level difference between two points using dumpy level
19	Onsite quality assessment of brick, and cement

20	Construct a 1 and 1 ½ thick brick wall with a height of 50 cm and a minimum length of 60 cm using English bond. Check the verticality of the wall
21	Construct a 1 and 1 ½ thick brick wall with a height of 50 cm and a minimum length of 60 cm using Flemish bond. Check the verticality of the wall
22	Estimate the number of different types of building blocks needed to construct the walls of a room measuring 2m x 3m, accounting for standard-sized doors and windows.
23	Setting out of a two roomed building using thread, tape and water tube levelling.
24	Conduct a market study to understand the types, prices, and general specifications of at least three materials available in the market (such as bricks, cement, aggregates, steel, plumbing items, fixtures, welding rods, fasteners etc.).
25	Studying the tools and testing instruments for electrical works. Wiring a light or a fan circuit using one way and two-way switch.
26	Familiarization/Application of testing instruments and commonly used tools in electronicworks. [Multimeter, Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and desoldering station etc.]
Note: *Minimum of 12 experiments from among the 26 experiments listed, is to be completed.*	

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 validinference/ 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 record.*
- *Minimum Pass Mark: The requirement for passing the lab course included in the first-year curriculum is that the student must score a minimum of 50% overall, combining marks from bothContinuous Internal Evaluation (CIE) and End Semester Examination (ESE). There is noseparate minimum requirement for each component.*
- *There will not be any relaxation in the attendance requirement.*

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify workshop operations and instruments in accordance with the material and objects.	**K3**
CO2	Understand appropriate tools and instruments with respect to the workshop specializations.	**K2**
CO3	Apply various tools, measuring devices, practices and different methods employed in the industry.	**K3**
CO4	Examine the quality of common materials used in the industry.	**K3**
CO5	Conduct market study of various engineering materials and consumables available in the market.	**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		2
CO2	3									2		2
CO3	3				2					2		3
CO4	3									2		3
CO5	3								2	3		3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechanical Workshop Practice	K C John	PHI Learning	Edition 2 2010
2	Engineering Materials	S C Rangwala	Charotar Publishing House Pvt Limited	Edition 43 2019
3	Building Materials	S K Duggal	New Age International	Edition 6 2025
4	Indian Practical Civil EngineeringHandbook	Khanna P.N,	UBS Publishers Distributers (P) Ltd.	Year 2012
5	Building Construction	Arora S.P and Bindra S.P	Dhanpat Rai Publications	Edition 5 Year 2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Elements of Workshop Technology Vol-1-ManufacturingProcesses	S K Hajra Choudhury A K Hajra Choudhury Nirjhar Roy	MPP Media Promoters and Publishers	2008

Video Links (NPTEL, SWAYAM…)
Link ID
https://archive.nptel.ac.in/courses/105/106/105106206/
https://archive.nptel.ac.in/courses/105/106/105106201/
https://archive.nptel.ac.in/courses/105/104/105104101/
https://archive.nptel.ac.in/courses/117/106/117106108/

Continuous Assessment (45 Marks)

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

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

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

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

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

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

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

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

Evaluation Pattern for End Semester Examination (50 Marks)

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

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

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

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

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

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

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

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

5. **Record (5 Marks)**

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

SEMESTER S1/S2

HEALTH AND WELLNESS

(Common to all Groups)

Course Code	**UCPWT127**	**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 equivalentof task (MET) Exercise Continuum: Light-intensity physical activity, Moderate - intensityphysical activity, Vigorous -intensity physical activity. Defining Physical Activity, Aerobic Physical Activity, Anaerobic PhysicalActivity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme	4

	Components of Health-related Physical Fitness: - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	
2	Concept of Health and Wellness: Health and wellness differentiation,Factors affecting health and wellness. Mental health and Factors affectingmental health. Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept ofBalanced 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) - HeimlichManeuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	**2**

Additional Topics

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

Course Assessment Method
(CIE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

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

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

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

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

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

Students will be evaluated as follows.

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

Activity Evaluation - Special Considerations - NCC	Students who enrolled themselves in the NCC during the course period (between the start and end dates of the program) and attended 5 college level parades will be awarded pass marks for activity evaluation. Students who attend more parades will be eligible for a maximum mark of 20 based on their parade attendance.

Tests to evaluated as per Criterion - 2 and Benchmark Scores

V Sit Reach Test

How to Perform:

1. The subject removes their shoes and sits on the floor with the measuring line between theirlegs 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 themeasuring 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 isrecorded.

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

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.

4. 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 theactivity table given below.
- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. Theyshould 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 completethe activity.
- Students should maintain a portfolio file with all the reports and other textual materials generated from the activities. Students should also keep a journal related to the activities undertaken.
- Portfolio and journal are mandatory requirements for passing the course, in addition to the

minimum marks required.

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

Table 1. Activity Table

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

	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 role storming exercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role-storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	● Empathy	CO2
4.1	Each student connects and networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (at least 1 through LinkedIn)	SS	3	I	2	● Workplace awareness ● Listening ● Communication - interacting with people ● Networking through various media including LinkedIn ● Discussion in groups ● Report preparation ● Creativity Goal setting - Preparation of action plan	
4.2	Interact with them to understand their workplace details including ● workplace skills required ● their work experience ● activities they have done to enhance their employability during their B. Tech years ● suggestions on the different activities to be done during B. Tech years Prepare a documentation of this	SS	3	I	4		CO2
4.3	Discuss the different workplace details & 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	SS	4	G	3		CO4

	discussions						
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	CO4

11.2	Activities to help students identify errors in English language usage	L	9	I/G	2	• English language skills	CO4
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L	10	I/G	2	• Writing • Presentation • Group work • Self-reflection	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

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

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

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 C

SEMESTER S2

MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE – 2

(Common to Groups 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 slope3s, 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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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 ofmultivariable functions and to apply in engineering problems.	**K3**
CO2	Understand theoretical idea of multiple integrals and to apply them tofind areas and volumes of geometrical shapes.	**K3**
CO3	Compute the derivatives and line integrals of vector functions and tolearn their applications.	**K3**
CO4	Apply the concepts of surface and volume integrals and to learn theirinter-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	Advance 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 PHYSICAL SCIENCE AND LIFE SCIENCE

(Common to Group C & D)

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

Course Objectives:

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

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Laser & Fiber Optics** Optical processes – Absorption-Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing – Population inversion- Pumping- Metastable states, Basic components of laser - Active medium - Optical resonant cavity, Construction and working of Ruby laser and CO2 laser, Construction and working Semiconductor laser (qualitative), Properties of laser, Applications of laser. Optic fiber-Principle of propagation of light, Types of fibers-Step index and Graded index fibers - Multimode and single mode fibers, Acceptance angle, Numerical aperture –Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	**9**
2	**Interference and Diffraction** Introduction, Principle of super position, Constructive and destructive interference, Optical path, Phase difference and path difference, Cosine law- reflected system- Condition for constructive and destructive interference, Colours in thin films, Newton's Rings-Determination of refractive index of transparent liquids and wavelength, Air wedge- Measurement of thickness of thin sheets. Diffraction-types of diffraction, Diffraction due to a single slit, Diffraction grating – Construction - grating equation, Dispersive and Resolving Power(qualitative).	**9**

3	**Quantum Mechanics** Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle- Absence of electron inside nucleus - Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (qualitative)	**9**
4	**Waves & Acoustics** Waves- transverse and longitudinal waves, Concept of frequency, wavelength and time period (no derivation), Transverse vibrations in a stretched string- derivation of velocity and frequency - laws of transversevibration. Acoustics- Reverberation and echo, Reverberation time and its significance - Sabine's Formula, Factors affecting acoustics of a building. Ultrasonics- Piezoelectric oscillator, Ultrasonic diffractometer, SONAR, NDT-Pulse echo method, medical application-Ultrasound scanning (qualitative)	**9**

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

Continuous Internal Evaluation Marks (CIE):

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

End Semester Examination Marks (ESE)

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

Part A	Part B	Total
• 2 Questions from eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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 principles and properties of laser and optic fibers.	**K2**
CO2	Describe the phenomena of interference and diffraction of light.	**K2**
CO3	Explain the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics.	**K2**
CO4	Apply the knowledge of waves and acoustics in non-destructive testing and in acoustic design of buildings.	**K3**
CO5	Apply basic knowledge of principles and theories in physics to conduct experiments.	**K3**

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

CO-PO Mapping Table:

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

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

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

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

1. Continuous Assessment (10 Marks)

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

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

ii. Conduct of Experiments (2 Marks)

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

iii. Lab Reports and Record Keeping (3 Marks)

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

iv. Viva Voce (3 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.*

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 andunderstanding 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 orprogramming 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 thesubject.

Experiment List

Experiment No.	Experiment (Minimum 10 Experiments)
1	Optical fiber characteristics- Measurement of Numerical aperture.
2	Determination of wavelength of Laser using diffraction grating.
3	Measure the wavelength of Laser using a millimetre scale as a grating.
4	Determination of wavelength of a monochromatic light using Newton's Rings method.
5	Determination of diameter of wire or thickness of thin sheet using Air wedge method.
6	Determination of slit width (diffraction due to a single slit).
7	Measure wavelength of light source using diffraction grating.

8	Determination of resolving power and dispersive power of grating.
9	Characteristics of LED.
10	CRO basics-Measurement of frequency and amplitude of wave forms.
11	Solar Cell- I V and Intensity Characteristics.
12	Melde's experiment- Frequency calculation in Transverse and Longitudinal Mode.
13	LCR circuit –forced and damped harmonic oscillations.
14	Determination of wavelength and velocity of ultrasonic waves using ultrasonicdiffractometer.
15	Determination of particle size of lycopodium powder.

SEMESTER S1/S2

CHEMISTRY FOR PHYSICAL SCIENCE

(Group C)

Course Code	**GCCYT122**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory + Lab

Course Objectives:

1. To equip students with a thorough understanding of chemistry concepts relevant to engineering applications.
2. 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 quality of life.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	**Engineering Materials** **Fuels:** Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels. Analysis of coal – Proximate analysis- Octane & Cetane Number. Biofuels- Biodiesel- Green Hydrogen. **Lubricants**: Classification - Solid, Semisolid and Liquid lubricants. Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud Point,Pour Point & Aniline Point. **Cement:** Manufacture of Portland cement – Theory of setting and hardeningof cement.	**9**

	Nanomaterials: Classification based on Dimension & Materials- Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials –Supercapacitor Materials - Carbon Nanotubes, Fullerenes & Graphene – structure, properties & application. Polymers: ABS & Kevlar -Synthesis, properties and applications. Conducting Polymers- Classification – Application	
2	**Electrochemistry and Corrosion Science** Electrochemical Cell- Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE & Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode & pH Measurement-Conductivity- Measurement using Digital conductivity meter. Li-ion battery & H_2-O_2 fuelcell (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**
3	**Instrumental Methods of Analysis** **Molecular 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:** –TGA- Principle, instrumentation (block diagram) andapplications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle,instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. **Chromatography-** Gas Chromatography- Principle-Instrumentation-Application – Analysis of chemical composition of exhaust gases. **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 **Waste Management**: Air Pollution- Sources & Effects- Greenhouse Gases- Ozone depletion. Control methods. Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Solid waste-disposal methods- Composting, Landfill & Incineration.	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	InternationalEdition-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 PhysicalChemistry	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 Materialsand Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications ofThermal 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 understandingof the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of thetheoretical background related to the experiments.

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

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

4.Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles duringa 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 andunderstanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizingmaterials/equipment.
- Setup and Execution: Proper setup and accurate execution of the experiment or programmingtask.

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

ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING

Course Code	**GCEST203**	**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	**CourseType**	Theory & Lab

Course Objectives:

1. To learn the principles and techniques of dimensioning and preparation of drawings
2. To develop the ability to accurately interpret 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. (Noquestions for the end semester examination) Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Traces 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 Cylinder and tetrahedron. 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 tetrahedron, Prisms, Pyramids, Cone, Cylinder 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, Frustum of Pyramid, Frustum of Cone, 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, onlyinternal evaluation)	**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)

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

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

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand and plot the projection of points and lines located in different quadrants	**K3**
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	Ist Edition 2012
2	Engineering Graphics,	Benjamin, J.	Pentex Publishers	5th Edition 2017
3	Engineering Graphics fordegree	John, K. C.	Prentice Hall India Publishers	Publishe din 2011
5	Engineering Graphics,	Anilkumar, K. N.	Adhyuth Narayan Publishers	10th Edition 2016

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	2009
2	Engineering Drawing & Graphics	Venugopal, K.	New Age International Publishers	4th edition 2007
3	Engineering Drawing	Parthasarathy, N. S., andMurali, V.	Oxford University Press	2015

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 S2

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to Group C & D)

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

Course Objectives:

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

SYLLABUS

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

	AC circuits: Purely resistive, inductive and capacitive circuits; Inductive and capacitive reactance, concept of impedance. (Simple numerical problems) **Three phase AC systems**: Representation of three phase voltages; star and delta connections (balanced only), relation between line and phase voltages,line and phase currents **Power in AC circuits** – Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems)	
2	**Generation of electrical energy:** Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description) **Introduction to non-conventional energy sources**: solar, wind, small hydroplants, PV system for domestic application. **Transformers. Principle of operation, step-up and step-down transformers** **AC power supply scheme:** Single phase and three phase system, Three phase 3 wire and 4 wire systems, Transmission System, Distribution system: Feeder, distributor, service mains **Types of Motors –** Principle of Operation: Block diagram showing power stages, losses and efficiency (electrical and mechanical and overall efficiency); Simple numerical efficiency **Introduction to different types of DC and AC motors.** Classification and different type of dc and ac motors, common applications: Principle oftraction and applications **Earthing:** need for earthing, Types of earthing; pipe earthing, plate earthing; **Principle of operation of MCB, ELCB/RCCB**	**11**
3	**Introduction to Semiconductor devices:** Electronic components- Passive and active components - Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, colour coding. PN Junction diode: - Principle of operation, V-I characteristics. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation	**11**

	Digital Electronics: -Binary number system, Boolean algebra and Logic Gates, Universal gates. Basic electronic circuits: - Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: - Transistor as an amplifier, Block diagram of Public Address system	
4	**Electronic Instrumentation:** Quality of measurements -accuracy, precision, sensitivity and resolution, Working principle and applications of Sensors – pressure – strain gauge, Bourden gauge, temperature – RTD, thermocouple, proximity – capacitive sensor, ultrasonic sensor and accelerometer. Internet of things (IoT): Introduction, architecture of IoT, Implementation of smart city – street lighting, smart parking.	**11**

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

Continuous Internal Evaluation Marks (CIE):

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

End Semester Examination Marks (ESE)

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

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

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Apply fundamental concepts and circuit laws to solve simple DC/AC electric circuits	**K2**
CO2	Develop an awareness on the fundamentals of electric power generation, transmission and distribution	**K3**
CO3	Compare different types of DC and AC motors	**K2**
CO4	Describe the fundamental concepts of electronic components and devices	**K2**
CO5	Outline the basic principles of an electronic instrumentation system	**K2**
CO6	Identify important applications of modern electronics in the contemporary world	**K2**

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Basic Electrical Engineering	D P Kothari and I J Nagrath	Tata McGraw Hill	4/e 2019
2	Schaum's Outline of Basic Electrical Engineering	J.J.Cathey and Syed A Nasar	Tata McGraw Hill	
3	Basic Electronics: Principlesand Applications	Chinmoy Saha, Arindham Halder andDebarati 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 Louis Nashelsky	Pearson	11e 2015
6	Principles of Electronic Communication Systems	Frenzel, L. E	McGraw Hill	4e 2016
7	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill	1/e 2017
8	Electronic Communication	Dennis Roddy and John Coolen	McGraw Hill	4/e 2008
9	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2/e 2019

SEMESTER S2

ENGINEERING ENTREPRENEURSHIP AND IPR

(Common to all Branches)

Course Code	**UCEST206**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	2:1:0:0	**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 businessideas.
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 forstartups.
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 **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	**9**

	• Role of IPR in securing funding and competitive advantage **Importance of building a strong team** • Identifying roles • Skill sets • Team dynamics **Identifying Pain Points and problem statement** • Idea Generation Techniques • Developing and Refining Ideas • Develop strategies for bringing your innovation to life	
2	**Problem and solution canvas preparation** • Orientation and canvas introduction • Customer needs assessment • Market segmentation • Value proposition • Competitive analysis • Market entry strategy • Market validation • Regulatory and legal considerations **Customer profiling** • Review of market research • Customer segmentation • Customer profiling • Persona development • Validation and feedback • Prioritisation and selection • Communication and messaging **Competitor analysis** • Identify competitors • Competitor profiling • SWOT analysis • Market positioning • Customer feedback and reviews • Pricing analysis • Differentiation strategy	**9**

	• 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 andprototype 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 8 Questions, each carrying 3**marks** **(6x2 =12 marks)**	• 2 questions will be given from each module, out ofwhich 1 question should be answered. Each question can have a maximum of 3 subdivisions. Each question carries 9 marks. **(4x7 = 28 marks)**	40

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Engineering Handbook	Richard C.Dorf	CRC Press	
2	The Innovator's DNA	Clayton M. Christensenand 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	**UCPWT127**	**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 equivalentof task (MET) Exercise Continuum: Light-intensity physical activity, Moderate - intensityphysical activity, Vigorous -intensity physical activity. Defining Physical Activity, Aerobic Physical Activity, Anaerobic PhysicalActivity, 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) - HeimlichManeuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	**2**

Additional Topics

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

Course Assessment Method
(CIE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

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

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

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

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fit to be Well Essential Concept	Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S.	Jones & Bartlett Learning.	2018
2	Introduction to physical education, fitness, and sport.	Siedentop, D., & Van der Mars, H.	Human kinetics.	2022
3	Substance Use Disorders. Manual for Physicians.	Lal, R., & Ambekar,A.	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 applicationon 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 theactivity table given below.
- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. Theyshould 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 completethe activity.
- Students should maintain a portfolio file with all the reports and other textual materials generated from the activities. Students should also keep a journal related to the activities undertaken.

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

Table 1: Activity Table

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

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

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

	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 practiced during theirB.Tech years, in order to achieve the set goals	SS	1	I	2		CO1
2.4	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role-storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	• Empathy	CO2
4.1	Each student connects and networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (at least 1 through LinkedIn)	SS	3	I	2	• Workplace awareness • Listening • Communication - interacting with people • Networking through various media including LinkedIn • Discussion in groups • Report preparation • Creativity • Goal setting - Preparation of action plan	
4.2	Interact with them to understand their workplace details including ● workplace skills required ● their work experience ● activities they have done to enhance their employability during their B. Techyears ● suggestions on the different activities to be done during B. Tech yearsPrepare a documentation of this	SS	3	I	4		CO2
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	SS	3	G	2		CO2
4.4	Report preparation based on the discussions	SS	4	G	3		CO4

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

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

SEMESTER S2

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

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

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

Course Objectives:

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

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

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

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

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

Continuous Internal Evaluation Marks (CIE):

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

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

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

- ***Submission of Record: Students shall be allowed for the end semester examination only uponsubmitting the duly certified record.***
- ***Minimum Pass Mark: The requirement for passing the lab course included in the first-year curriculum is that the student must score a minimum of 50% overall, combining marks from both Continuous Internal Evaluation (CIE) and End Semester Examination (ESE). There is no separate minimum requirement for each component.***
- ***There will not be any relaxation in the attendance requirement.***

Course Outcomes (COs)

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

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

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

CO-PO Mapping Table:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5. **Record (5 Marks)**

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

SEMESTER S2

CIVIL ENGINEERING DRAFTING LAB

(Common to CE and CV)

Course Code	**PCCEL208**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:2:0	**ESE Marks**	50
Credits	1	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	GCEST104/ Equivalent	**Course Type**	Practical

Course Objectives:

1. To introduce the fundamentals of Civil Engineering Drawingand understand the principles of planning.
2. To enable students to learn the drafting of buildings manually and using drafting software.

Details of Experiment

Expt. No	Experiment
1	Introduction to Civil Engineering Drawing, Concept of Scale, Plan, Section and Elevation. Drawing tools and accessories, Manual and Computer Aided Drafting Draw the view of simple objects (books, shelves, benches, etc.) adopting appropriate scales
2	Draw sectional details and elevation of paneled doors.
3	Draw sectional details and elevation of wooden glazed window.
4	Draw elevation, section and detailing of connection between members for steel roof truss
5	Draw plan, section and elevation of dog legged staircase
6	Prepare a model of a single storied building with card board from given drawings (Not expected to complete in the lab hours)
7	Draw plan, section and elevation of single storied residential building from the given line sketch.

8	Draw plan, section and elevation of two-storied framed building from the given line sketch.
9	Draw plan, section and elevation of an industrial building.
10	Introduction to Auto CAD: Preparation of CAD drawing of any of the building components (Experiments 2-5)
11	Preparation of CAD drawing of plan, section and elevation of single storied residential building (Experiment 7).

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work, experiments, Viva andTimely 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

Mandatory requirements for ESE:

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

Course Outcomes (COs)

At the end of the course the student will be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Illustrate ability to organize civil engineering drawings systematically and professionally	**K2**
CO2	Illustrate the detailing of building components like doors, windows, roof trusses etc.	**K2**
CO3	Develop the sketch of plan, front elevation and sectional elevation from line diagram.	**K3**
CO4	Draft the plan elevation and sectional views of the residential buildings, industrial buildings, and framed structures using software.	**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	1		2
CO2	3							3	3	1		2
CO3	3							3	3	1		2
CO4	3				2			3	3	1		2

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	Building Drawing and Detailing	Dr. Balagopal T.S. Prabhu	Spades Publishers, Calicut	Revised Edition 2022
2	Building Drawing With An Integrated Approach to Built Environment	Shah, M.G., Kale, C. M. and Patki, S.Y.	Tata McGraw Hill Publishing Company Limited, New Delhi	5th edition 2017
3	Building Planning and Drawing	M.V. Chitawadagi S.S. Bhavikatti	Dreamtech Press	2019

References	
Sl. No	**Title of the Book**
1	National Building Code of India (refer the latest updates)
2	Kerala panchayat building rules (refer the latest updates)
3	Kerala Municipality building rules (refer the latest updates)
4	IS962: 1989 (Reaffirmed 2022) Indian Standard Code of practice forarchitectural and building drawings

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 understanding of 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, and troubleshooting 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 and maintaining a well-organized fair record.

4. **Viva Voce (5 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 End Semester Examination (50 Marks)

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

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

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

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

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

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

9. Viva Voce (10 Marks)

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

10. Record (5 Marks)

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

PROGRAMME CORE 1

SEMESTER S2

MECHANICS OF SOLIDS

(CIVIL ENGINEERING)

Course Code	**PCCET205**	**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)	GCEST103/ Equivalent	**Course Type**	Theory

Course Objectives:

1. To provide students with a fundamental understanding of the mechanics of deformable bodies and help them develop their analytical and problem-solving skills.
2. To introduce students to the various internal effects induced in structural members and their deformations due to different types of loading.
3. To enable students to determine the stress, strain, and deformation of loaded structural elements.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Concept of stress and strain – types, stress – strain relation - Hooke's law, Young's modulus of elasticity. Stress-strain diagram of mild steel. Factor of safety, working stress. Axially loaded bars with uniform and uniformly varying cross section–stress, strain and deformation. Temperature effects, temperature stress in composite bars. Shear stress and shear strain, Modulus of rigidity, simple shear, punching shear. Lateral strain, Poisson's ratio, volumetric strain. Bulk modulus of elasticity, relationships between elastic constants.	**11**

	Strain energy – concept. Strain energy due to normal stress. Strain energy inbars carrying axial loads. Strain energy due to shear stress.	
2	Beams – different types. Types of loading on beams. Concept of bending moment and shear force. Relationship between intensity of load, shear force and bending moment. Shear force and bending moment diagrams of cantilever beams, simply supported beams and overhanging beams fordifferent type of loads. Point of contraflexure.	**11**
3	Theory of simple bending, assumptions and limitations. Calculation of normal stress in beams, moment of resistance. Shear stress in beams. Beams of uniform strength. Strain energy due to bending – calculation of strain energy in beams. Derivation of differential equation for calculating the deflection of beams – Macaulay's method.	**10**
4	Stresses on inclined planes for uniaxial and biaxial stress fields. Principal stresses and principal planes, maximum shear stress in 2D problems.Mohr's circle of stress for 2D problems. Short coluMin – direct and bending stress. Kern of a section. Slender coluMin – Euler's buckling load, slenderness ratio, limitation of Euler's formula. Rankine's formula. Torsion of circular and hollow circular shafts, Power transmitted by circularshafts and hollow circular shafts. Strain energy due to torsion.	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Recall the fundamental terms and theorems associated with mechanics of linear elastic deformable bodies.	**K1**
CO2	Explain the behavior and response of various structural elements under various loading conditions.	**K2**
CO3	Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants and strain energies in structural elements subjected to axial/transverse loads and bending/twisting moments.	**K3**
CO4	Choose appropriate principles or formula to find the elastic constants of materials making use of the information available.	**K3**
CO5	Perform stress transformations, identify principal planes/ stresses and maximum shear stress at a point in a structural member.	**K3**
CO6	Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.	**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	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	-

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechanics of Structures	H. J. Shah and S. B. Junnarkar	Charotar Publishing House	32nd Edition 2016
2	A Text book of Strength of Materials	R. K. Bansal	Laxmi Publications	6th Edition 2018
3	Mechanics of Materials	B. C. Punmia, Ashok K. Jain, Arun Kumar Jain	Laxmi Publications	Revised Edition 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Mechanics ofSolids	Egor P. Popov	Prentice Hall International Series	2nd Edition 2015
2	Mechanics of Materials	James M Gere, S.P. Timoshenko	CBS Publishers and Distributors	2nd Edition 2004
3	Mechanics of Materials	R.C. Hibbeler	Pearson	10th Edition 2018
4	Strength of Materials	S. Ramamrutham and R.Narayanan	Dhanpat Rai Publishing Co	18th Edition 2014
5	Strength of Materials	Rattan	McGraw Hill Education India	3rd Edition 2016

Video Links (NPTEL, SWAYAM…)	
Sl No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/104/105104160/

SEMESTER S2

PROCESS CALCULATIONS

(CHEMICAL ENGINEERING)

Course Code	**PCCHT205**	**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 establish fundamental principles of Chemical Engineering in a simple and up-front manner and to provide the broad background for applying these principles to theoretical and industrial problems.
2. To introduce the basic concepts of composition calculations practiced in chemical processes, gas laws, material and energy balances etc. which are at the fundamental and core areas of Chemical Engineering course.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Basic Concepts:** Introduction to Chemical Engineering, Chemical process Industry, Unit Operations and Unit Processes. Units and Dimensions, Conversion of units, Conversion of equations- problems. Composition of solids, liquids and solutions - weight percent, mole percent, molarity, normality, molality, ppm Gaseous mixtures, Composition of gaseous mixtures, Average molecular weight and density, Ideal gas law, Dalton's Law, Amagat' Law, Vander Waals equation Vapour Pressure: Effect of temperature on vapour pressure – Antoine Equation, Clausius-Clapeyron equation.	**11**

	Problem solving in Equations of state, Vapor Pressure calculation using EXCEL /Matlab/ SCILAB/PYTHON etc. – only for self- study /microproject/assignment.	
2	**Material Balance for unit operations**- Introduction, key component Material balance for unit operations like mixing, distillation, drying, evaporation, absorption, crystallization, extraction, leaching.	**11**
3	**Material Balance for unit processes** - Definition of terms - limiting reactant, excess reactant, percentage yield, conversion, selectivity Orsat analysis, Material Balance for combustion, Recycle, bypass and purge operations. Problem solving in Material balance using EXCEL/ Matlab/ SCILAB/ PYTHON etc.- only for self-study/microproject/assignment.	**11**
4	**Energy Balance**: Heat capacity of solids, liquids and gaseous mixtures, Kopp's Rule, Latent Heats-Heat of fusion, heat of vaporization, Estimation of Heat of Vaporization - Kistyakowsky Equation, Trouton's rule, Watson equation. Heat effects accompanying chemical reactions - Standard heats of reaction, standard heat of combustion, and standard heat of formation, Hess's law of constant heat summation. Effect of temperature and pressure on heat of reaction, temperature of reaction, adiabatic reaction temperature.	**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 eachmodule. • Total of 8 Questions, eachcarrying 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 subdivisions. **(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 fundamentals of Chemical Engineering, units and dimensions and estimate chemical composition and other physical quantities of solids, liquids, solutions, gases and mixtures	**K3**
CO2	Develop and solve basic material balance equations for the unitoperations employed in process industries.	**K3**
CO3	Develop and solve basic material balance equations for the unit processes employed in process industries.	**K3**
CO4	Develop and solve energy balance equations for various physical andchemical processes.	**K3**
CO5	Implement and run software programs for solving stoichiometricproblems	**K5**

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Stoichiometry and Process Calculations	K.V. Narayanan, B. Lakshmikutty	Prentice-Hall of India Pvt. Ltd.	2nd edition 2016
2	Stoichiometry	B.I. Bhatt, S.M. Vora	McGraw Hill Publishing Company Limited.	6th edition 2021
3	Basic Principles & Calculations in Chemical Engineering	David M. Himmelblau, James B. Riggs	Prentice-Hall of India Pvt. Ltd.	8th edition 2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Chemical Process PrinciplesPart-I: Material and Energy Balances	O.A.Hougen, K.M.Watson, R.A.Ragatz	CBS Publishers NewDelhi	2nd Edition1962
2	Elementary Principles of Chemical Processes	Richard M. Felder, Ronald W. Rousseau	Wiley	4th edition 2018

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/103/105/103105209/
2	https://archive.nptel.ac.in/courses/103/105/103105209/
3	https://archive.nptel.ac.in/courses/103/105/103105209/,
4	https://archive.nptel.ac.in/courses/103/105/103105209/

SEMESTER S2

MATERIAL SCIENCE AND ENGINEERING

(MECHANICAL ENGINEERING)

Course Code	**PCMET205**	**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 recognize the importance of the microstructures and physical properties of the materials to enable the material selection process.
2. To develop an understanding of the basic principles of phase transformations and apply those principles to engineering applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to material science: Classification of engineering materials, Structure of solids- Metallic, Ionic and covalent bonding. Properties based on atomic bonding. Crystallography: - SC, BCC, FCC, HCP structures, APF - theoretical density simple problems – Miller Indices: - crystal plane and direction - Modes of plastic deformation:- Slip and twinning	**11**
2	Crystal imperfections – - Point defects, Line defects, Surface defects, Volume defects. edge and screw dislocations – Burgers vector – interaction between dislocations. Polishing and etching, Metallographic characterisations of metallic	**11**

	materials. SEM, TEM- Grain size determination Wear, Roughness, Corrosion. Diffusion in solids, fick's laws, mechanisms, applications of diffusion in mechanical engineering, simple problems. Applications of Diffusion.	
3	Mechanical properties: Tensile properties, Hardness and hardness measurement, Impact properties, Fatigue, Creep, DBBTT, Super plasticity. Types of steels- low, medium and high carbon steels, stainless steels, alloy steels and their applications. Properties and applications of composites, super-alloys, intermetallic- Stoichiometric and Non stoichiometric compounds- Applications. maraging steel, Titanium-Ceramics:- structures, applications	**11**
4	Phase diagrams: - need of alloying - classification of alloys - Hume Rothery`s rule – equilibrium diagram of common types of binary systems: isomorphous (Cu- Ni) eutectic (Pb- Sn), lever rule and Gibb`s phase rule. Detailed discussion on Iron- Carbon equilibrium diagram with microstructure and properties -Heat treatment: - TTT, CCT diagram, applications - Tempering- Hardenability, Jominy end quench test, applications-Surface hardening methods.	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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 crystal structures (BCC, FCC, and HCP), and their relationship with the properties.	**K2**
CO2	Understand the crystallographic defects through metallography	**K2**
CO3	Compare the material properties among different materials for material selection.	**K2**
CO4	Define and differentiate the microstructure of metallic materials using phase diagrams.	**K4**

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Material Science andEngineering, 2014	Callister William.D	John Wiley	2014
2	Engineering Metallurgy part-I	Higgins R.A	Arnold	6th ,1998

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The science and engineering of materials	Donald R Askeland	Thomson	
2	Introduction to Physical Metallurgy	Avner H Sidney	Tata McGraw Hill	2009
3	Material Science and Engineering	Raghavan V	Prentiece hall	2004

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/113/105/113105103/
2	https://archive.nptel.ac.in/courses/113/105/113105103/
3	https://archive.nptel.ac.in/courses/113/105/113105103/
4	https://archive.nptel.ac.in/courses/113/105/113105103/

SEMESTER S2
AUTOMOBILE POWER PLANT

(AUTOMOBILE ENGINEERING)

Course Code	**PCAUT205**	**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 code)	**Course Type**	Theory

Course Objectives:

1. Understand the functions of internal combustion engine components, valve actuatingmechanisms, air-fuel systems, and Ignition systems.
2. Study the influence of fuel injection methods, ignition timing, and exhaust gas treatment onthe performance of IC engines.
3. Understand the importance and components of cooling and lubrication systems in IC engines.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	ENGINES: Basic engine nomenclature, Classification & Applications of IC Engines. Constructional details of engine components: Cylinders – types, Cylinder liners, Engine block, Cylinder head, Gasket, Piston, Piston rings, Piston pins, Connecting rod, Crank shaft, Flywheel, Cam shaft, Valve and valve mechanism systems - OHV, OHC, DOHC. Valve Timing Diagram & Port timing diagrams, Inlet and Exhaust manifold.	**11**

2	FUEL SUPPLY SYSTEM: Air fuel mixture requirements and types, Octane & Cetane Rating. Types offuel feed systems, fuel tank, fuel pumps and fuel filters, air filter types. Carburetion, simple carburetor, Fuel injection system - GDi, MPFi. Fuel supply system in diesel engines: components of diesel fuel system, feed pump, injection pump, injection nozzles and types, Governors. Electronic Unit Injectors, CRDi system	**11**
3	IGNITION & EMISSION SYSTEM: Ignition system in IC engines: Ignition System Overview Battery ignition system, magneto ignition system, distributor less ignition – CDI & Coil on plug type of ignition system Pollutants in IC Engines. NOx, CO, unburned hydrocarbons, smoke and particulate. Non exhaust emissions and control methods, Exhaust gas treatment. - Catalytic converter – Thermal reactor - Particulate trap, Exhaust Gas Recirculation (EGR) Systems. Exhaust mufflers, Types of mufflers.	**11**
4	COOLING & LUBRICATION SYSTEM Need for cooling, types- air cooling system and liquid cooling systems- components- radiator, water pump and cooling fan. Properties of coolants and additives. Requirements of lubrication systems. Types of Lubrication system. SAE Ratings Multi grade lubricants, Pre-lubrication systems. Supercharging and Turbocharging in I C Engines.	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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 constructional details and working of various internal combustion engine	**K2**
CO2	Discuss the fuel system & air induction system for IC engines	**K2**
CO3	Explain the Ignition system & emission in IC engines	**K2**
CO4	Understand the Cooling and lubrication system for IC engines	**K2**

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Internal Combustion Engines	Ganesan. V	Tata McGraw-Hill Publishing Co	4th Edition 2017
2	Internal Combustion Engines	Ramalingam K.K	Sci-Tech Publications	3rd Edition 2018
3	Internal Combustion Engines	R.K. Rajput	Laxmi Publications.	2nd Edition 2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A course in internal combustionengines	Mathur. M.L.,Sharma. R.P	Dhanpatrai publication	2016
2	Internal Combustion EnginesFundamentals	John Heywood	McGraw Hill International Edition	2nd Edition 2018
3	Fuels & Combustion	Smith, Marion L. And Karl W. Stinson	McGraw-Hill	

Video Links (NPTEL, SWAYAM…)	
Sl. No	**Link ID**
1	I C Engines and Gas Turbines https://archive.nptel.ac.in/courses/112/103/112103262/# Fundamentals of Automotive Systems https://archive.nptel.ac.in/courses/107/106/107106088

SEMESTER S2

TRANSDUCERS & MEASUREMENTS

(MECHATRONICS ENGINEERING)

Course Code	**PCMRT205**	**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 provide students with a comprehensive understanding of various types of transducers used in engineering applications, including their principles of operation and characteristics.
2. To familiarize students with different measurement techniques and instruments commonly used in engineering, enabling them to apply these techniques effectively for accurate measurement and analysis in practical scenarios

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to transducers and sensors Definition of sensors and transducers –Mechanical devices as Primary Detectors-Pressure Sensitive Primary Devices- Temperature Detectors- Hydro pneumatic Devices. Electric Transducers. Advantages of Electrical Transducers. Classification of Electrical Transducers- Primary and Secondary Transducers, Active and Passive Transducers, Analog and Digital Transducers. Electrical Phenomena Used in Transducers.	**11**

2	Resistive Transducers- Potentiometers, Strain gauges-gauge factor-Resistance Thermometers, Thermistors. Capacitance transducers - piezo electric transducers – Inductive transducers: LVDT characteristics-photoelectric sensors – Hall Effect transducers - measuring circuits-calibration- Optical transducers. Ionization transducers. Digital Transducer. Shaft Encoder.	**11**
3	Measurements and Measurement Systems Measurements- Significance of Measurements- Methods of Measurement: Direct &Indirect Methods-Instruments-Mechanical, Electrical and Electronic instruments- Classification of Instruments-Analog and Digital Modes of Operation-Functions of Instruments and Measurement Systems- Applications of Measurement Systems-Elements of a Generalized Measurement System- Characteristics of Instruments and Measurement Systems: Measurement system Performance- Static Calibration- Static Characteristics- Errors in Measurements-True Value-Static Error- Static Correction -Scale Range and Scale Span- Error Calibration Curve- Reproducibility and Drift- Accuracy and Precision, Linearity. Hysteresis-type of errors-classification of errors	**11**
4	DC bridges: introduction, sources and detectors-General Equation-Types of bridges: Wheatstone, Kelvin bridge- AC bridges: introduction, sources and detectors-General equation. Maxwell's inductance and Maxwell's inductance -capacitance bridge. Cathode ray oscilloscopes: principles, construction and limitations-Digital storage oscilloscopes: principles- Measurements using CRO s and DSOs- Recording instruments: Strip chart recorder, X-Y Plotter, LCD displays.	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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	Summarize the concepts of sensors, transducers and classify varioustransducers.	**K2**
CO2	Apply the principles and functions of various types of Transducers inmeasuring systems.	**K3**
CO3	Illustrate the working principles of electronic measuring instruments and identify various types of errors in measuring systems and choose methods for minimization of the errors.	**K3**
CO4	Explain the concepts of CRO, DSO, various recording devices.	**K2**
CO5	Understand and utilize various measurement systems, enhancing theircapability to apply theoretical knowledge in practical scenarios	**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				1							3
CO2	3				1							3
CO3	3	2										3
CO4	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	A Course in Electronic Measurements and Instrumentation	A. K. Sawhney	Dhanpat Rai & Co.	2015 Edition
2	Electronic Instrumentation andMeasurements	David A Bell	Oxford University Press	3rd Edition 2013
3	Electronic Instrument Design	Kim R Fowler	Oxford reprint	2nd Edition, 2015

Reference 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	2nd edition, 2003
2	Electronic Instrumentation andMeasurements	Kalsi HS	Mc Graw hill	4th edition, 2019.
3	Electrical Measurements and Measuring systems	Golding E W and Widdis F C	Wheeler&co	1993

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://www.youtube.com/watch?v=1uPTyjxZzyo
2	https://onlinecourses.nptel.ac.in/noc23_ee105/preview
3	https://nptel.ac.in/courses/112107242
4	https://onlinecourses.nptel.ac.in/noc23_ee112/preview https://www.youtube.com/watch?v=0FVzYLEdSA8

SEMESTER S2

FUNDAMENTALS OF MANUFACTURING SYSTEMS AND PROCESSES

(PRODUCTION ENGINEERING)

Course Code	**PCPET205**	**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. Summarize about Manufacturing Systems and Strategies
2. Identify the appropriate process for a given engineering material.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Manufacturing Systems, Classification of Manufacturing Systems; Discreet Manufacturing, Repetitive Manufacturing, Job Shop Manufacturing, Batch Manufacturing, Continues manufacturing, Additive Manufacturing. Manufacturing Strategies; Lean Manufacturing, Mass Customization, Green Manufacturing, Total Quality Management, Agile Manufacturing, Just in Time. Original Equipment Manufacturer, Reconfigurable Manufacturing, Assembly Lines, Concept of Inventory. (Should cover basics concepts only)	**11**

2	Glass and Ceramic Manufacturing; Relevant Properties of glass and ceramics, Processing Steps; Mixing, melting, forming, cooling and finishing, equipment's used for processing: rotary kiln, tumbler, ball milling, hydraulicpresses & jiggers. Plastic Manufacturing; Relevant Properties of Plastics, Processing Methods;Plastic Extrusion, Injection Moulding, Rotational Moulding, Plastic extrusion & injection blow moulding, Vacuum casting. Thermoforming & Vacuum forming, Compression moulding. Rubber Manufacturing; Relevant properties of Rubber, Processing Steps; mastication, mixing, shaping, , calendaring, curing. Textile Manufacturing: Weaving; Cutting. Spinning, Yarn production, Dyeing, Pattern making, Bleaching, Grading, Packing, Wet processing. (Should cover basics concepts only)	**11**
3	Metal industries –Ferrous Metals and Alloys- -raw materials for iron making, blast furnace and electric furnace operation, shaping and finishing, application of iron and steel. Non-Ferrous Metals, examples of nonferrous metals- extraction of ore,smelting &refining, shaping and finishing, alloying, application of nonferrous metals. (Should cover basics concepts only)	**11**
4	Wood based integrated Pulp and paper mill – Wood chips production, Batch digester, Pulp washing filters, bleaching, drying and calendaring. Cement manufacturing process- flow diagram, raw mill circuit, cement beneficiation, Manufacturing method and equipment used in Portland cement manufacture Petroleum refining process- flow diagram illustrating refining of crude oil well to saleable product. (Should cover basics concepts only)	**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, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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	Summarize about Manufacturing Systems and Strategies	**K2**
CO2	Explain the manufacturing processes involved in polymer, ceramic and textile industries	**K2**
CO3	Classify the manufacturing processes involved in metal industries.	**K2**
CO4	Outline the manufacturing processes involved in cement paper and petroleum industries.	**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				2	
CO2	3	3	3				2				2	
CO3	3	3	3				2				2	
CO4	3	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	Fundamentals of Modern Manufacturing, Materials, Processes and Systems	Mikell P Groover	Wiley	7th Edition, 2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Ceramics, Glass and Glass-Ceramics	Francesco Baino (Editor),Massimo Tomalino (Editor), Dilshat Tulyaganov(Editor),	Springer.	Kindle edition 2021
2	Modern Plastic Handbook	Charles A. Harper	McGraw Hill	1999
3	The Complete Book on Rubber Processing and Compounding Technology	NIIR Board of Consultantsand Engineers	NIIR Board of Consultants andEngineers	2011
4	Textbook of Fabric Science:Fundamentals to Finishing	Seema Sekhri	PHI.	Kindle edition 2011
5	Ironmaking and Steelmaking:Theory and Practice	Ahindra Ghosh	PHI.	1st edition 2008
6	Manufacturing Technology of Non-Ferrous Metal Products	Brahmpal Bhardwaj	Engineers India Research Institute	1st edition 2012
7	The chemical process industries	R . Norris Shreve	Mc Graw Hill	2nd edition 1956
8	Energy performance assessment for equipment and utility systems	Buraeu of energy efficiency	Buraeu of energy efficiency	4th edition 2015

SEMESTER S2

FUNDAMENTALS OF AERONAUTICS AND AIRCRAFT INSTRUMENTS

(AERONAUTICAL ENGINEERING)

Course Code	**PCAOT205**	**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. Introduce the basic concepts of aeronautics
2. Discuss about instruments, display and navigation systems employed in aircraft.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	**Atmospheric properties:** Physical properties and structure of atmosphere-temperature, pressure and altitude relations. **Basic concepts of Aeronautics:** Laws of motion applied to aeronautics. Aerodynamic forces, Nomenclature and Classification of airfoil, mean aerodynamic chord, Centre of pressure and aerodynamic center, Types of drag - reduction techniques, Aerofoil characteristics: lift and drag curves, Speed of sound, Mach number, aspect ratio, wing loading. (Numericals)	**11**
2	**Aircraft Classification and Components:** Aircraft classifications. Airplane configurations based on wing, landing gear, engines attachments. Components of Wing, Fuselage-Fuselage Construction Truss, Monocoque, Semi-Monocoque. Control surfaces and maneuvers.	**9**

3	**Basic Instruments:** Pitot static system, Pitot static instruments: Altimeter, Vertical speed indicator, Airspeed indicator. Mach meter, Gyroscope, heading indicator, Turn coordinator, Engine instruments: Temperature gauges, Pressure gauges, Tachometer: Mechanical and Electrical. Modern control systems-Fly by wire systems and Auto pilot systems.	**13**
4	**Cockpit Display systems:** Head Up Display, Head Down Display, Helmet Mount Display, Multifunctional Keyboard, Multifunctional Display, Direct Voice Input, Hands on Throttle and Stick. **Navigation systems:** Distance Measuring Equipment, Very High Omnidirectional Range, Automatic Direction Finder, Instrument Landing System, Microwave Landing Systems, Inertial Navigation Systems, Global Positioning System.	**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 fullquestion 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, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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 structure of atmosphere and basic concepts of aircraft	**K2**
CO2	Describe the classification, components, and maneuvers of airplane	**K2**
CO3	Explain the basic working principles of various aircraft instruments.	**K2**
CO4	Understand the principles and working of various cockpit display and aircraft navigation systems.	**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
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Flight	J D Anderson Jr. and Mary L.Bowden	Mc Graw Hill	Ninth Edition 2021
2	Aircraft Instruments	EHJ Pallet	Pearson	Second Edition 2009
3	Mechanics of Flight	AC Kermode, RH Barnard, D R Philpott	Pearson	Eleventh Edition 2006
4	Flight Physics	E Torenbeek, H.Wittenberg	Springer	2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Flight without Formulae	A C Kermode	Pearson	
2	The Avionics Hand Book	Spitzer CR	CRC Press	Second Edition 2006
3	Avionics Training systems, Installation and troubleshooting	Len Buckwalter	Avionics Communication	Second Edition 2005
4	Fundamentals of Flight	Richard S Shevell	Pearson	

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
Module - I	archive.nptel.ac.in/courses/101/104/101104061/
Module - II	archive.nptel.ac.in/courses/101/101/101101079/
Module - III & IV	archive.nptel.ac.in/courses/101/104/101104061/

SEMESTER S2

CROP PRODUCTION & PROTECTION TECHNOLOGIES

(AGRICULTURE ENGINEERING)

Course Code	**PCAGT205**	**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 understand the principles of agricultural crop production and protection practices ofdifferent crops
2. To understand the role and importance of Agricultural Engineers in crop production
3. To equip the students with the basic principles of cropping and cultivation practices ofimportant crops of Kerala.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	Introduction to agriculture -Importance of agricultural science for crop production - Branches of agricultural science-National and international agricultural research Institutes - Basic elements of crop production - Agricultural seasons in India and Kerala. Classification of crops based on the intensity of cultivation, uses, life span, growth habit, and climatic response and/or habitat. Factors affecting crop growth and production: genetic (internal) and environmental (external) factors. Crop management through environmental modification and adaptation of crops to the existing	**11**

	environment through crop cultural practices. Competition among crop plants -Selection of crops- seed rate, seed treatment, raising of nursery and production of quality planting material. Field preparation for crops including systems of tillage; Spacing and arrangement of crop plants; Establishment of an adequate crop stand and ground cover. Types and methods of harvest	
2	Crop rotation, cropping systems, cropping scheme, relay cropping, mixed cropping and intercropping. Soil-water-plant relationship, crop coefficients, water requirement of crops and critical stages for irrigation; Weeds and their management in crops; Time and method of sowing of major field crops, seed rate for important crops; Methods and time of application of manures and fertilizers, fertigation; Horticulture- Branches-Scope and importance; Seed rate and seed treatment for vegetable crops; Macro and micro propagation methods; Types of plant growing structures; Pruning and training; Orchard- site selection, layout andManagement of orchard.	**11**
3	Definition of soil. Different functions of soil in our eco system namely as medium of plant growth, Regulator of water supply, Recycle of raw materials, Modifier of atmosphere, Habitat for organisms, Engineering medium etc. Soil profiles and horizons: O, A, B and C. Soil as an interface of solids, water and air and their percentage composition. Formation of soils: Weathering of rocks and minerals, Physical weathering, Biogeochemical weathering, Factors influencing soil formation, soil taxonomy orders. Important soil physical properties: texture, structure, density, porosity, consistency, temperature. The concepts of soil fertility and productivity. The essential elements and their functions in plants. Soil colloids – properties – nature - types and significance. Layer silicate clays - their genesis	**11**

	and sources of charges. Adsorption of ions - ion exchange - CEC and AEC - factors influencing ion exchange and its significance. Concept of pH - soil acidity - brief overview of saline, sodic and calcareous soils. Soil organic matter – composition – decomposability – humus.	
4	Organic and inorganic fertilizers- its Importance- soil reactions. Gypsum requirement for reclamation of sodic soils and neutralizing RSC; Liquid fertilizers and their solubility and compatibility. Major pests and diseases of field crops and horticultural crops and their management. Integrated methods of managing water, nutrients and plant protection. Crop production technology of field crops in Kerala: cereal crops, grain legumes, oil seed crops, sugarcane, and fibre crops. Cultivation practices of horticultural crops: vegetable crops, fruit crops, flower crops.Basic principles of natural farming, organic farming and sustainable agriculture	**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 eachmodule. • Total of 8 Questions, eachcarrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, outof which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(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 general crop production techniques of field crops and horticultural crops.	**K2**
CO2	Explain the factors affecting crop growth and explain environmental management for crop production.	**K2**
CO3	Identify different crops and understand the growing seasons of major crops of Kerala	**K3**
CO4	Describe crop water management, nutrition management and crop protection	**K4**
CO5	Explain cultivation practices of various field crops and horticultural crops commonly grown in Kerala	**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							1					3
CO2		1			2		2					1
CO3	1	2	2		1		3					
CO4	2	1				2	2					
CO5		2					1		1			2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Textbook of Field Crops Production Vol 1: Foodgrain Crops (PB)	Dr. Rajendra Prasad	Indian Council of Agricultural Research, New Delhi	First Edition, 2006
2	Textbook of Field Crops Production: Commercial Crops Vol. II	Dr. Rajendra Prasad	Indian Council of Agricultural Research, New Delhi	First Edition, 2006
3	Principles of Agronomy	T. Yellamanda Reddy and G.H.Sankara Reddy	Kalyani Publishers, New Delhi	First Edition, 2005
4	Fundamentals of Agronomy	Amal Saxena and Lal Singh	Write And Print Publications, New Delhi	First Edition, 2008
5	Text Book of Soil Science.	Biswas, T.D. andMukherjee, S.K.	Tata McGraw Hill Publishing Co., NewDelhi	
6	Introductory Soil Science. .	Das.D.K	Kalyani Publishers, New Delhi	

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Handbook of Agriculture.		ICAR Publications, New Delhi	6th Revised Edition, 2011.
2	Vegetable Crops of India.	Das P.C.	Kalayani Publishers, New Delhi	1993
3	Fundamentals of Agronomy.	De, G.C.	Oxford & IBH Publishing Co Pvt Ltd, New Delhi	1989
4	Introduction to Horticulture	Kumar N.	Rajalakshmi Publications, Nagarcoil	7th Edition, 2015
5	Nature and Properties of Soils.	Brady, N.C	Pearson	

SEMESTER S2

MATERIALS AND MANUFACTURING ENGINEERING

(INDUSTRIAL ENGINEERING)

Course Code	**PCIET205**	**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. Equip students with a comprehensive understanding of engineering materials, including crystal structures, phase diagrams, phase transformations, and heat treatment processes.
2. Provide fundamental knowledge of manufacturing processes and familiarize students with modern production methods and technologies.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Materials and Types of Materials:** Metals, polymers, ceramics, composites, advanced materials, biomaterials, nanomaterials, smart materials, energy materials, sustainable and green materials. **Crystal Structure:** Crystal lattices and the unit cell. Simple cubic, BCC, FCC, HCP crystal structures. Atomic packing factor. Crystallographic points,directions, and planes, Miller's indices. **Crystal Imperfections**: Point defects, line defects (dislocations), surface defects, volume defects. **Microscopic Techniques:** Polishing and etching techniques. Electron Microscopy, Transmission Electron Microscopy and Scanning Electron Microscopy. Grain size determination (ASTM). **Elastic and Plastic Deformation:** stress-strain diagram, true stress and true strain, flow stress. Schmidt's law. Slip and twinning.	11

2	**Phase Diagram:** Basic concepts: Solubility limit, solvent, solute, solid solutions, Hume Rothery's rule, phase and phase equilibrium, Gibb's phase rule. Alloys, need for alloying. Types of Phase diagrams, Invariant reactions, Iron-iron carbide equilibrium diagram, TTT diagram, CCT diagram, Formation of pearlite, bainite, and martensite. **Heat Treatment:** Basic principles of annealing, normalizing, hardening, spherodizing, and tempering. Surface hardening techniques: Carburizing, nitriding, flame hardening, induction hardening, laser hardening **Basics of fatigue and Creep:** Fatigue, S-N curve, factors affecting fatigue life. Creep, factors affecting creep.	**10**
3	**Rolling:** Principles of rolling, types of rolling mills, Various rolling processes and applications: hot rolling, cold rolling, ring rolling, thread rolling, tube rolling, shape rolling, skew rolling, defects in rolling. **Forging:** Classification of forging, various forging operations: cogging, coining, heading, piercing, hubbing, swaging, forging defects. **Extrusion:** Process, types of extrusion: hot extrusion, cold extrusion, direct (forward) extrusion, indirect (backward) extrusion, hydrostatic extrusion, impact extrusion, applications and defects. **Drawing:** Process, applications and defects. Wire drawing process. **Sheet-Metal Forming:** Bending sheet, plate and tubes. springback, press brake forming, stretch forming, deep drawing, hydroforming, spinning, tube spinning.	**11**
4	**Casting:** cores, shell mold casting, plaster mold casting, ceramic mold casting, investment casting, permanent mold casting, pressure casting, die casting, centrifugal casting, casting defects. **Welding:** weldability, solidification of weld metal, heat affected zone, gas welding, arc welding (including GTAW, MIG, TIG, plasma arc welding, submerged arc welding), ultrasonic welding, friction welding, resistance welding (spot and seam), thermit welding, welding defects. **Adhesive joints**: Basic principles and applications. **Additive Manufacturing (3D Printing):** Basic principles, processes, materials used, applications, future trends. **Sustainability in Manufacturing:** Sustainable practices, recycling of materials, environmental impacts. **Smart Manufacturing and Industry 4.0:** Introduction to IoT, automation,and data analytics in manufacturing.	**12**

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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, outof 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 types of engineering materials, their crystal structures, imperfections, and the principles of elastic and plastic deformation.	**K2**
CO2	Interpret phase diagrams, understand phase transformations, and analyse the principles and techniques of heat treatment, fatigue, and creep.	**K3**
CO3	Apply principles of various metal forming and shaping processes, including rolling, forging, extrusion, drawing, and sheet-metal forming, and identify associated defects.	**K3**
CO4	Understand and evaluate casting processes, welding techniques, adhesive joints, additive manufacturing, sustainability in manufacturing, and the implications of Industry 4.0 in smart manufacturing.	**K2**

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

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Materials Science and Engineering: An Introduction	William D. Callister Jr. and David G. Rethwisch	Willey	10th Edition, 2018
2	Materials Science and Engineering: A First Course	V. Raghavan	Prentice Hall India	6th Edition, 2015
3	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven Schmid	Pearson	8th Edition, 2020
4	Introduction to Manufacturing Processes	Mikell P. Groover	Wiley	12th Edition, 2020

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Principles of Materials Science and Engineering	William F. Smith	McGraw-Hill	4th Edition, 2005
2	The Science and Engineering of Materials	Donald R. Askeland, Wendelin J. Wright	Cengage Learning	7th Edition, 2015
3	Principles of Modern Manufacturing	Mikell P. Groover	Wiley	6th Edition, 2023
4	Manufacturing Engineering Handbook	Hwaiyu Geng	McGraw-Hill Education	2nd Edition, 2015
5	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David Rosen, Brent Stucker	Springer	3rd Edition, 2020
6	Sustainable Manufacturing	Kapil Gupta, Konstantinos Salonitis	Elsevier	2nd Edition, 2021

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/113/104/113104068/ https://nptel.ac.in/courses/113/106/113106034/ https://nptel.ac.in/courses/113/104/113104005/ https://archive.nptel.ac.in/courses/112/106/112106293/ https://onlinecourses.nptel.ac.in/noc22_mm25/preview
2	https://nptel.ac.in/courses/113/106/113106032/ https://nptel.ac.in/courses/113/104/113104006/ https://onlinecourses.nptel.ac.in/noc24_me74/preview
3	https://nptel.ac.in/courses/112/105/112105126/ https://nptel.ac.in/courses/112/107/112107080/ https://onlinecourses-archive.nptel.ac.in/noc18_me49/preview
4	https://onlinecourses.nptel.ac.in/noc23_me90/preview https://onlinecourses.nptel.ac.in/noc21_me23/preview https://elearn.nptel.ac.in/shop/iit-workshops/completed/additive-manufacturing-technologies-for-practicing-engineers/?v=c86ee0d9d7ed https://onlinecourses.nptel.ac.in/noc22_me130/preview https://onlinecourses.nptel.ac.in/noc21_ce47/preview https://onlinecourses.nptel.ac.in/noc20_cs69/preview

SEMESTER S 2

BASIC SHIP THEORY

(NAVAL AND SHIPPING ENGINEERING)

Course Code	**PCNST205**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-1-0-0	**ESE Marks**	60
Credits	4	**ExamHours**	2 Hrs 30 Mins
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Explain various types of ships and fundamentals of Naval Architecture that would equip one to define hull forms geometrically, and develop them as lines plan drawings.
2. Apply the procedures of numerical integration to calculate hydrostatic properties, and plot sectional area curves, Bonjean curves, and hydrostatic curves.
3. Understand basic stability features of a ship using fundamental principles and hydrostatic curves
4. Explain the various types of shipbuilding materials and identify various major and minor structural components of a ship and identify the main and auxiliary machinery systems onboard.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Types of ships, terms and definitions, Archimedes principle, laws of floatation, weight and buoyancy. The ship's form, main dimensions, lines plan, coefficients and their meaning, Fairing process and table of offsets, Lines plan development and drawing	**11**
2	Integration rules: - Trapezoidal rule, Simpson's rules, Tchebycheff's rule, areas, volumes and moments, Bonjean calculations and curves, sectional area curves. Hydrostatic calculations and curves.	**11**

3	Potential energy and equilibrium, Stability of ships – stable and unstable conditions, Stability terms, Equal volume Inclinations shift of C.O.B. due to inclinations, C.O.B curve, metacentre, pro-metacentre and metacentric radius, metacentric height, metacentric curve, surface of flotation, curve of flotation, righting moment and righting lever	**11**
4	Frames, framing systems, primary and secondary members, shipbuilding materials, Bottom structure, shell structure, decks, bulkheads, superstructures, bulkheads, fore and aft structures. Main and auxiliary machinery, types of propulsion machinery, types of auxiliary machinery	**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	Identify various types of ships and understand fundamentals of Naval Architecture that would equip the student to define hull forms geometrically, and develop them as lines plan drawings.	K3
CO2	Understand and apply the procedures of numerical integration to calculate hydrostatic properties, and plot sectional area curves, Bonjean curves, and hydrostatic curves.	K2
CO3	Understand and explain basic stability features of a ship using fundamental principles and hydrostatic curves.	K2
CO4	Identify and explain the various types of shipbuilding materials and various major and minor structural components of a ship and identify the main and auxiliary machinery systems onboard.	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										
CO2	2	2			1							
CO3	2	2			1							
CO4	2	2										

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Naval Architecture	Tupper, E.C.	Butterworth-Heinemann	Edition 5, 2013
2	Ship Stability for Masters & Mates	C.B. Barrass & D.R.Derrett	Elsevier	Edition 7, 2019
3	Ship Construction	Eyres D J	Elsevier	Edition 7, 2012
4	Introduction to Marine Engineering	Taylor D A	Elsevier	Edition 2, 1996

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Maritime Engineering Reference Book	Molland A F (Ed)	Elsevier	Edition1, 2008
2	Encyclopedia of Ship Technology	Jan Babicz	Wärtsilä Corporation	Edition 2, 2015
3	Ship Knowledge – A Modern Encyclopedia	Klaas van Dokkum	DOKMAR	2003
4	Lecture Notes in Basic Naval Architecture	Spyros Hirdaris	Aalto University Publication Series, Science & Technology 6/2021	Edition 1, 2021

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/114105003
2	https://nptel.ac.in/courses/114105003
3	https://nptel.ac.in/courses/114105003
4	https://nptel.ac.in/courses/114105031

SEMESTER S2

POLYMERS & POLYMERISATION PRINCIPLES

(POLYMER ENGINEERING)

Course Code	**PCPOT205**	**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 understand the basic terminologies associated with polymer materials
2. To analyse various techniques and methods for polymer conversion.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Monomers and Polymers: Definitions of monomer, repeat unit, oligomer, polymer, degree of polymerization, representation of polymer, functionality, bi-functional systems, poly-functional systems, advantages and disadvantages of polymers, classification of polymers. structure of monomer, repeat unit and polymer of the following- polyethylene, polypropylene, polystyrene, PVC, polyacrylonitrile, polycarbonate, PMMA, PF resin, MF resin, Nylon 6, Nylon 66 and PET, epoxy polymer, Kevlar, natural rubber, silicone rubber.	**11**
2	Molecular weight: High molecular weight of polymers, concept of averaging, different averages in polymer molecular weight, number average, weight average, viscosity average, z-average, MWD, polydispersity index, principles of osmotic pressure method and viscometry, Experimental methods to determine weight average and z-average molecular weight.	**11**

3	Types of Polymerisation : Linear step polymerisation, Carothers equation, non linear step polymerization, Addition polymerization- Free radical polymerisarion,Cationic polymerization, anionic polymerization, Co-ordination polymerization, Co polymerisation, different types of copolymers, alternating, random, block and graft copolymer, copolymerization drift, derivation of copolymer equation.	**11**
4	Polymerisation techniques: Bulk polymerisation, Solution polymerisation, Suspension polymerization, Emulsion polymerisation, Interfacial polymerisation.	**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 structural requirements of polymerisation	**K2**
CO2	Illustrate structural formula of simple plastic and rubber materials	**K2**
CO3	Explain the basic concepts of average molecular weights	**K2**
CO4	Explain the basic principles of addition polymerization, stereo-regularity, ionic polymerisation and co polymerisation.	**K2**
CO5	Compare and correlate various polymerisation techniques.	**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	1									
CO2	3	3	2									
CO3	3	3	3									
CO4	3	3	1									
CO5	3	3	1									

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Elements of Polymer Science and Engineering	A. Rudin, P. Choi,	Academic Press	Third edition,2013
2	Textbook of Polymer Science	F W Billmeyer	John Wiley & Sons	Third Edition, 2007
3	Introduction to Physical Polymer Science,	L H. Sperling	Wiley & Sons	2015
4	Polymer Science	V. R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar	New Age International	2015

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Polymer Science for Engineers	S. Fakirov	John Wiley & Sons	2017
2	Polymer Chemistry	Charles E. Carraher Jr	CRC Press	2013
3	Introduction to Polymers	Robert J. Young	CRC Press	2011
4	Principles of Polymer Systems,	F. Rodrigues,	CRC Press	2014

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/content/mp4/105/106/105106205/MP4/mod01lec03.mp4
2	https://archive.nptel.ac.in/content/mp4/105/106/105106205/MP4/mod01lec05.mp4
3	https://archive.nptel.ac.in/content/mp4/105/106/105106205/MP4/mod09lec66.mp4
4	https://archive.nptel.ac.in/content/mp4/105/106/105106205/MP4/mod01lec06.mp4

SEMESTER S2

PRINCIPLES OF SAFETY MANAGEMENT

(SAFETY & FIRE ENGINEERING)

Course Code	**PCSFT205**	**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 learn the various principles of safety management and enable the students to give safety training, perform safety audit, and accident investigation.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction-Safety -Goals of safety engineering. Need for safety. Safety and productivity. Definitions: Accident, Injury, Hazard, Risk, Unsafe act, Unsafe Condition, Near miss, Dangerous Occurrence, Reportable accidents, Loss Prevention. History of Safety Engineering. Industrialization and Accidents, Evolution of modern safety concepts. Theories of accident causation--Ten Axioms of Industrial Safety, Heinrich's theory, Frank Bird's Domino theory, Hepburn's theory, V.L Grose's Multiple Causation Theory, System Model theory, Ferrell's Human Factors theory. Safety organization objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy - Safety department and size - Safety Officer- responsibilities, authority. Safety committee- Need, Types, Advantages.	**11**

2	Accident prevention Methods- Engineering, Education and Enforcement - Safety Education & Training -Importance, Various training methods, Effectiveness of training, Behaviour oriented training. Need and Reasons for Accident Prevention - 5E of Accident Prevention. Effective Communication- purpose, barrier to effective communication. Safety problems - employer's problem, employee's problem. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5S of housekeeping. Work permit system- objectives, hot work, cold work and other work permits. Safety psychology, Present Psychological Safety Problems General psychological factors- attitudes, aptitudes, frustration, conflict, morale, fatigue, boredom and monotony. Differences in factors affecting safety performance Motivation for safety- Need of motivation, Theories of motivation- Maslow's hierarchy of needs, Herzberg hygiene Theory, Mc Gregor X &Y Theory. Methods of Motivation.	**11**
3	Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate, safety "t" score, and safety activity rate – problems. Cost of accidents. Computation of Costs- Utility of Cost data. Plant safety inspection, types, and inspection Procedure, safetysampling techniques, Typical industrial models and methodology. Entry into confined spaces.	**11**
4	Code of Practice on Safety Audit-IS 14489-Goals, Objectives and Responsibilities, Audit Methodology, Executing the Audit, Job safety analysis (JSA), Safety surveys, Non conformity reporting (NCR). Safety Inventory Technique. The practice of safety management-the significance of risk acceptability. Risk Management-Introduction to ISO 31000 - Accident investigation –Why? When? Where? Who? & How? Basics- Man-Environment & Systems Process of Investigation–Tools-Data Collection-Handling witnesses- Case study. Accident analysis. Analytical Techniques-System Safety-Change Analysis- MORT-Multi Events Sequencing-TOR	**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 concepts of safety, the theories of accident causation and duties of safety officer	**K2**
CO2	Explain functions safety organisation, accident prevention methods, concept of safety psychology and motivational theories	**K2**
CO3	Explain about personnel protective equipments and safety equipments, produce different types of work permits, and estimate safety performance using various indices	**K2**
CO4	Produce different types of accident investigation reports, and compliance check lists, Analyse job safety and accidents through JHA tools and accident models, estimate costs.	**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											
CO2	3											
CO3	3				1							
CO4	3	1			1							

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of industrial safety and health	Dr. K.U.Misthri	Siddharth Prakashan Ahmadabad	2012 Edition Vol.I&II
2	Safety Management in Industry	N.V. Krishnan	Jaico Publishing House, New Delhi	1997

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Industrial Accident Prevention	Heinrich H.W.	McGraw-Hill Company, New York,	1980.
2	Industrial Safety	Ronald P. Blake	Prentice Hall, New Delhi,	1973
3	Occupational Safety and health,	David L. Goetsch,	Prentice Hall	
4	Modern Accident Investigation and Analysis,	Ted S. Ferry	John Wiley & Sons	
5	Occupational Safety Management and Engineering,	Willie Hammer,	Prentice Hall	
6	Safety Management System,	Alan Waring	Chapman & Hall	
7	Safety Management,	John V. Grimaldi and Rollin H.Simonds,	All India Traveller Book Seller, Delhi.	
8	Accident Prevention Manual for Industrial Operations		National Safety Council, Chicago	
9	Loss Prevention in process industries	Lees F.P	Butterworth publications, London,	2nd edition,1990.